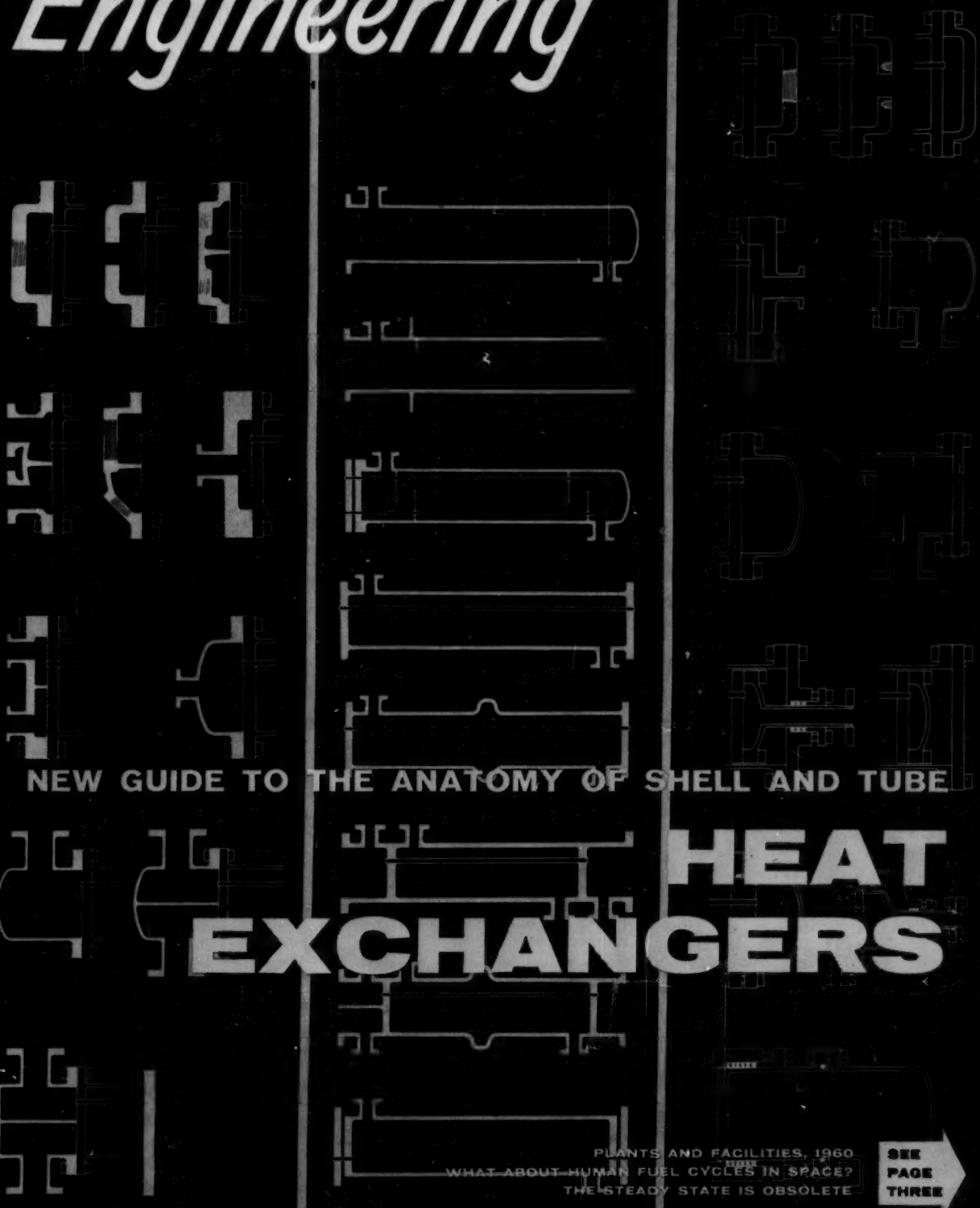
Chemical Engineering



NEW GUIDE TO THE ANATOMY OF SHELL AND TUBE

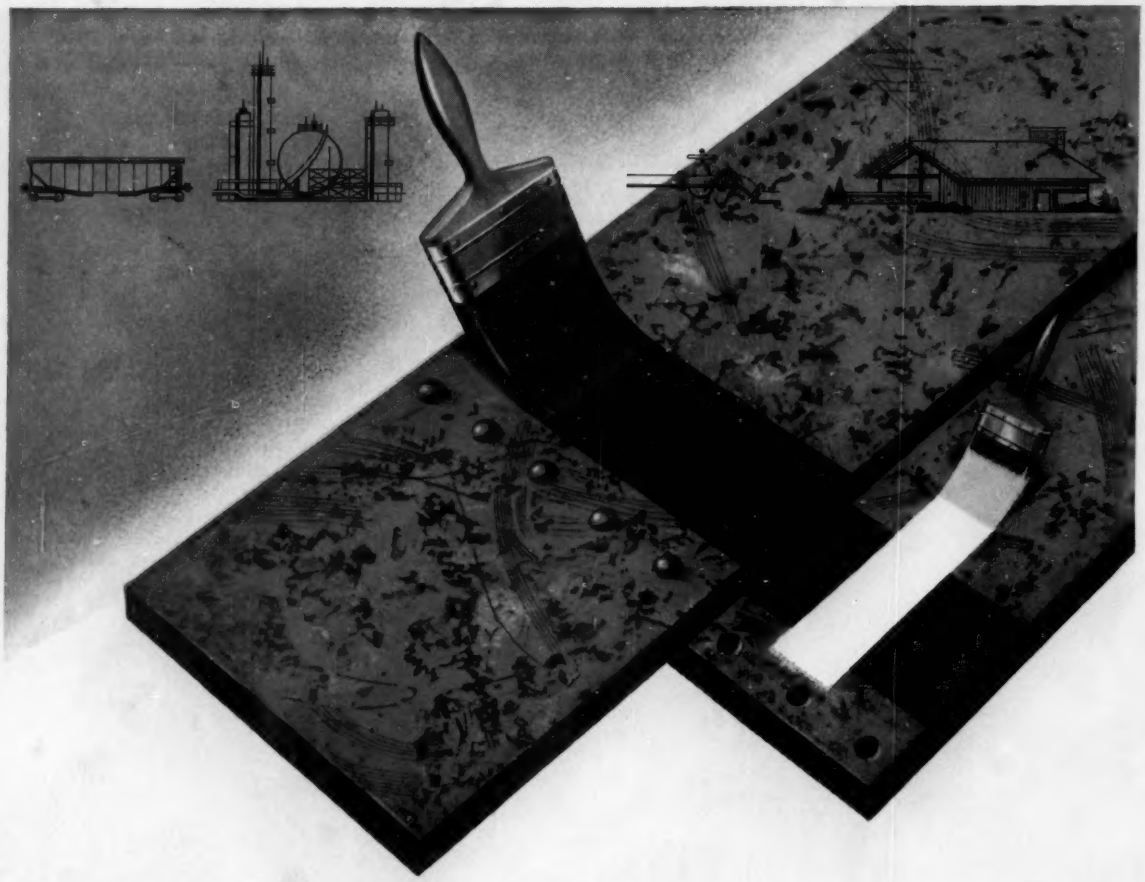
HEAT EXCHANGERS

PLANTS AND FACILITIES, 1960

WHAT ABOUT HUMAN FUEL CYCLES IN SPACE?

THE STEADY STATE IS OBSOLETE

SEE PAGE THREE



Important new development!

EPON® RESIN-BITUMEN C COATING— cold blend, high thermal stability

Now—for the first time—you can obtain complete compatibility between Epon resin and a heavy petroleum fraction.

Shell Chemical research has made it possible for you to combine Epon 828 liquid resin with a low-cost, petroleum-based material, *Bitumen C*. The resulting surface coating has a number of excellent properties never before attainable in a bituminous coating material:

- **Cold blending—no heating of pitch necessary**
- **Various film builds—up to 10 mils in one coat**
- **No pinholing—even in thin films**
- **Can be overcoated with white**
- **Imparts high thermal stability to bituminous coatings**
- **Permits use of conventional curing agents**
- **2-hour pot life**

This outstanding new Epon resin-Bitumen C coating is ideal for a wide range of anti-corrosion and waterproofing applications. To suggest just a few: pipelines, chemical plants, hopper cars, sewer pipe, waterproofing basements.

Both Bitumen C and Epon resin are available from Shell Chemical. Get off to a head start on this extraordinary new surface coating development by getting complete information. Write or phone your nearest Shell Chemical district office.

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PLASTICS AND RESINS DIVISION

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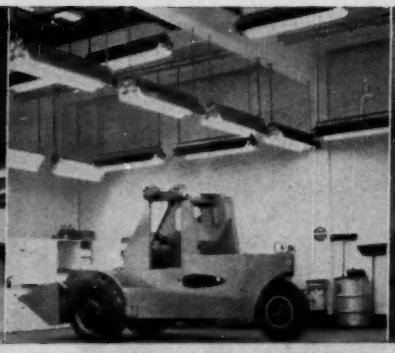
IN CANADA: Chemical Division, Shell Oil Company of Canada, Limited, Toronto

SHELL

"EFU" Explosion-Proof Fixtures Give Safe, Bright Illumination in Paint Plants . . .



Dependable, Trouble-Free Service in Hazardous Area Paint Shops . . .

Modern, 45° Angle Mount in Garage Pits . . . or Wherever Safe Lighting is Required

For Hazardous Area Lighting You Can Rely On...

APPLETON®

"EFU" Explosion-Proof Fluorescent Fixtures

Type "EFU" 2-Lamp Fixture 45° Angle Mounted and Suspended From Type "ESS" Swivel Mounted On "GRFC" Flanged Unilet With Canopy

Pat. No. 2,392,202 and Pat. Pending

Quality built in every detail, APPLETON "EFU" fixtures are prefectly designed and carefully constructed by experienced craftsmen. Factory sealing eliminates the need for external seals. In addition, all models have cast aluminum end housings containing terminal blocks where line connections are made, and aluminum threaded covers to protect line connections, starters and lamps from hazardous fumes, dirt or dust. All lamps are protected and totally enclosed by heavy Pyrex glass tubes. APPLETON "EFU" fluorescent fixtures are U.L. and C.S.A. approved and meet specifications of Article 500 of the National Electric Code.

Sold Through Franchised Distributors Only

- **Choice of 33 different models (see chart below)**
- **Available in 2, 3, or 4 lamp styles**
- **Choice of horizontal or 45° mounting**
- **Steel reflectors . . . white enameled inside, grey outside**
- **Relamping from either end**
- **"Rapid Start" ballast where desired**
- **Streamlined design, totally enclosed yet easily accessible**
- **Application layouts furnished by APPLETON upon receipt of installation data**

"EFU" Fixtures Available As Indicated By •

Circuit Voltage 60 Cycle	40 WATT, 48 INCH T-12			100 WATT, 60 INCH T-17—Bi-PIN		No. Lamps
	Bi-Pin		Single-Pin Instant-Start Slimline			
	Pre-Heat	Rapid-Start		Pre-Heat	Rapid-Start	
110—125	•	•	•	•		2
	•	•	•			3
	•	•	•	•		4
199—216	•					2
	•					4
220—250	•	•	•			2
	•					3
	•	•	•	•	•	4
250—290	•	•	•	•		2
		•	•			3
	•	•	•	•	•	4

APPLETON Electric Company

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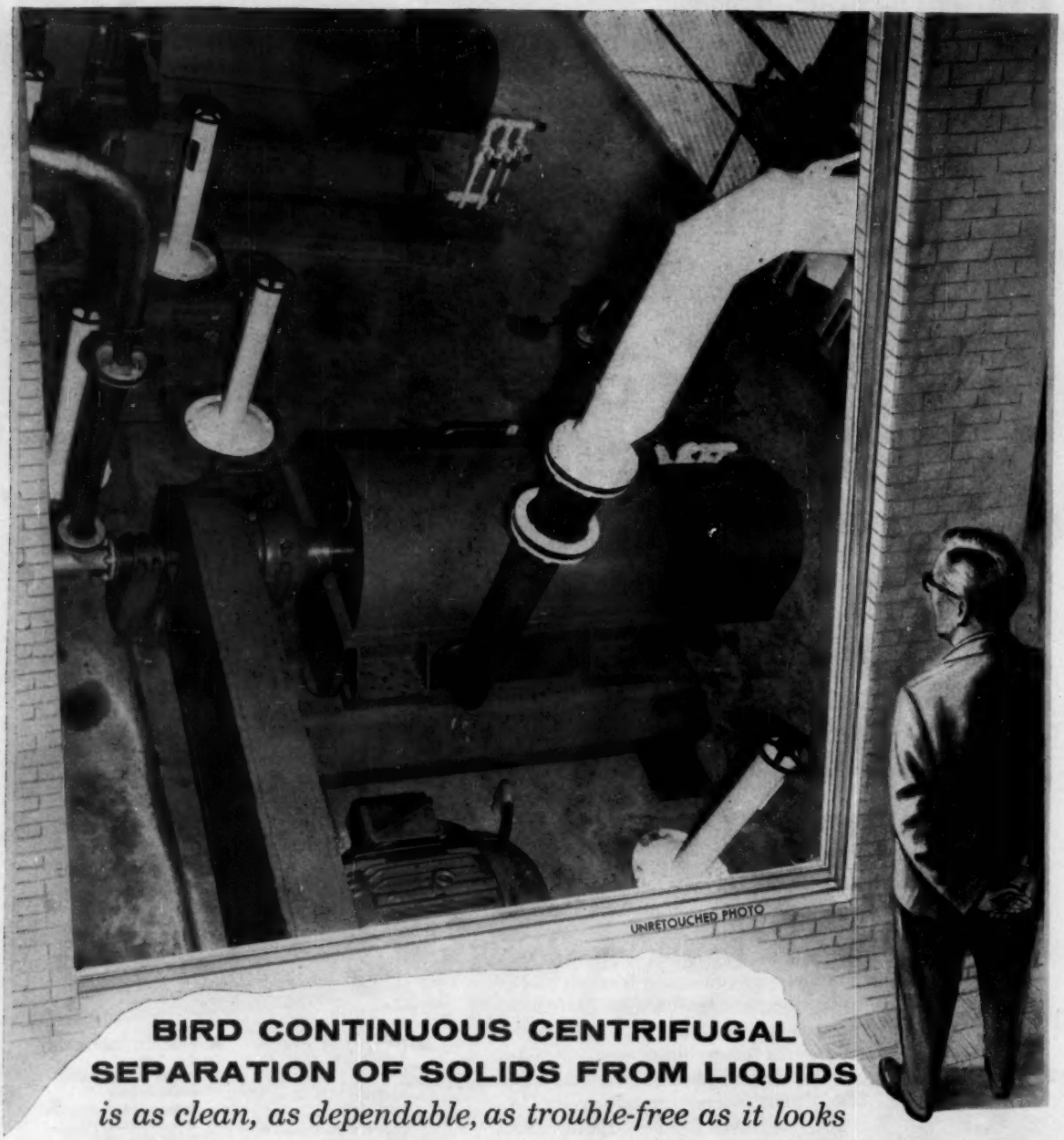
Also Manufacturers of:

Malleable Iron Unilets & Covers

"ST" Series Connectors

"Eagle Claw" Switch Boxes

Reelites



BIRD CONTINUOUS CENTRIFUGAL SEPARATION OF SOLIDS FROM LIQUIDS

is as clean, as dependable, as trouble-free as it looks

Sturdy, compact solid-liquid separating equipment like the Birds in the picture is a far cry from the sprawling, sloppy, wide open and often complex ways you used to put up with.

There is a Bird to fit the job however large or small. Bowl diameters range from 6 to 54 inches, separating forces from 30 to 3000 gs. Each size is subject to 25 variations in design. You can feed the Bird thick or thin, hot or cold slurries, in varying volumes and consistencies. Solids can be fine or coarse.

The Bird Research and Development Center is equipped to determine the one best Bird for you. Recommendations will be unbiased because Bird builds batch and screen centrifugals, drum and pan vacuum filters and pressure filters, too. Before you invest in solid-liquid separating of any kind, why not get all the facts and figures.

BIRD MACHINE COMPANY • SOUTH WALPOLE, MASS.

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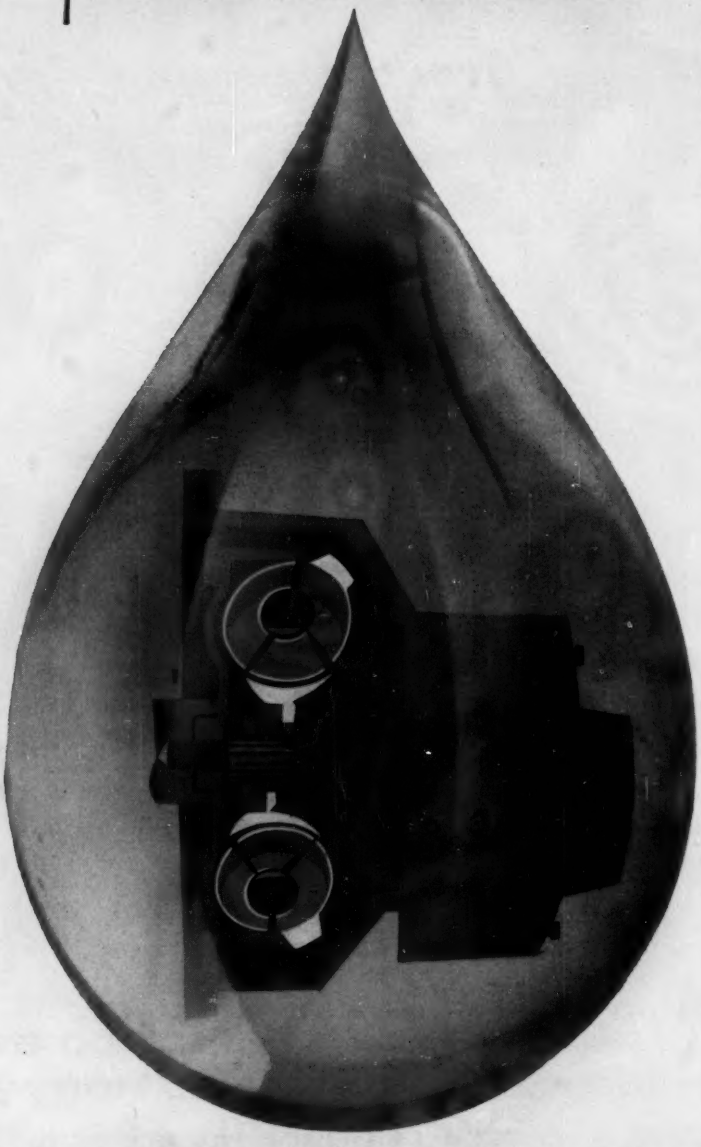

BUILD DENSE FLUIDS WITH BROMINE

Bromine, the only element besides mercury that's a liquid under ordinary conditions, has a density more than three times that of water. Specific gravity is 3.1 at 20/15°C. This property, plus ready ability to unite with other chemical compounds, makes bromine ideal for building high density fluids.

Take hydraulics, for example. Engineers are turning to nonflammable, brominated compounds to develop high density fluids to achieve more compact hydraulic systems.

Close tolerances of moving parts in delicate mechanisms become less important when high density brominated fluids are used. Hydraulic equipment size decreases with an increase in fluid density. You may also increase the power output of your present equipment by replacing the fluid now in use with a high density brominated system.

In other applications, bromine and brominated compounds serve as chemical intermediates in thousands of reactions. Recent fruits of continued research are new brominated compounds especially suited for specialized fire-fighting tasks.

Dow's first product nearly 70 years ago was bromine. Today, besides high-purity elemental bromine, Dow produces over 100 brominated compounds, with new ones constantly under study. And Dow is anxious to explore bromine's potential for helping you improve products and processes. For more information, write THE DOW CHEMICAL COMPANY, Midland, Mich., Chemicals Merchandising Dept. 651AK4-18.

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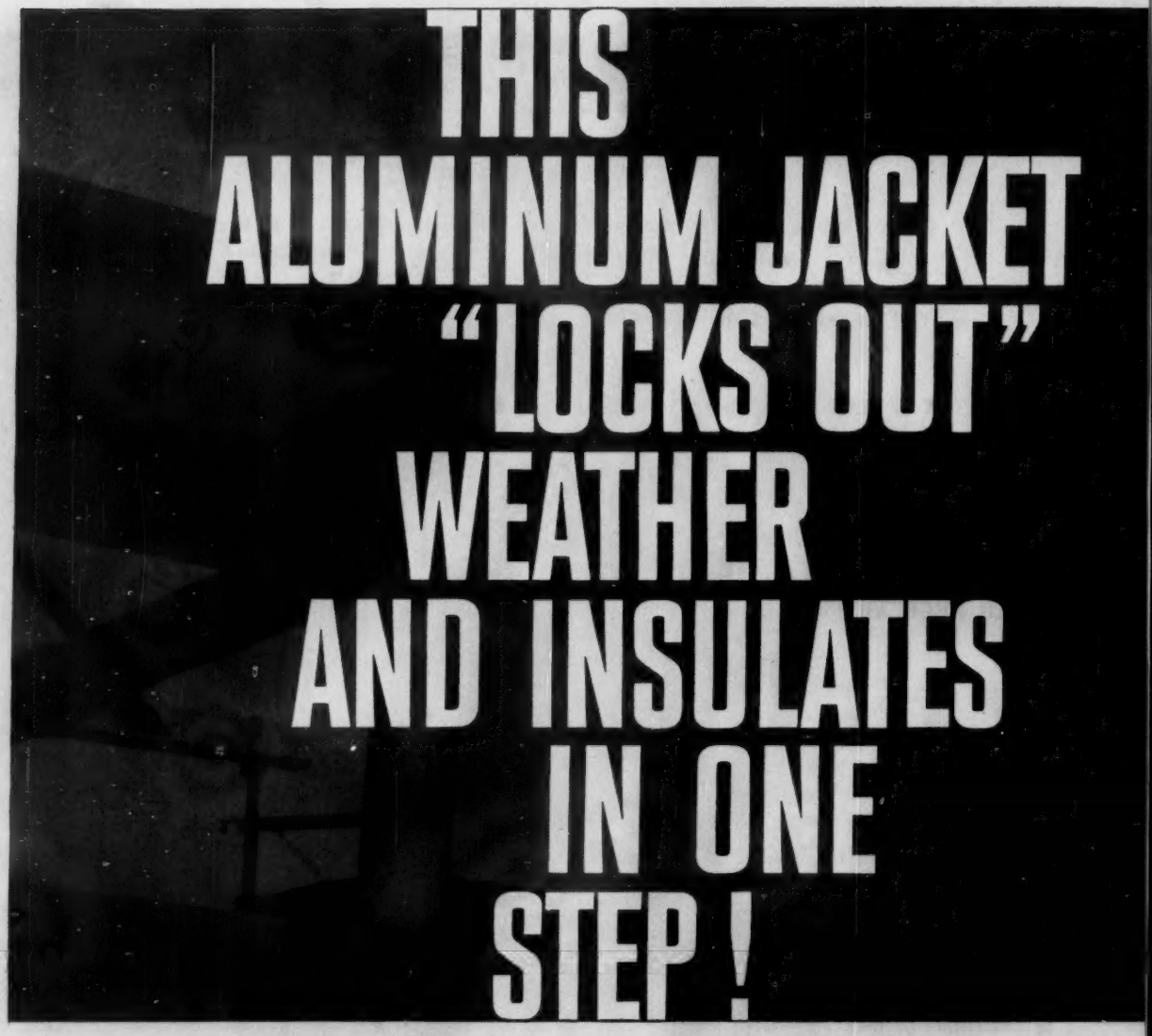
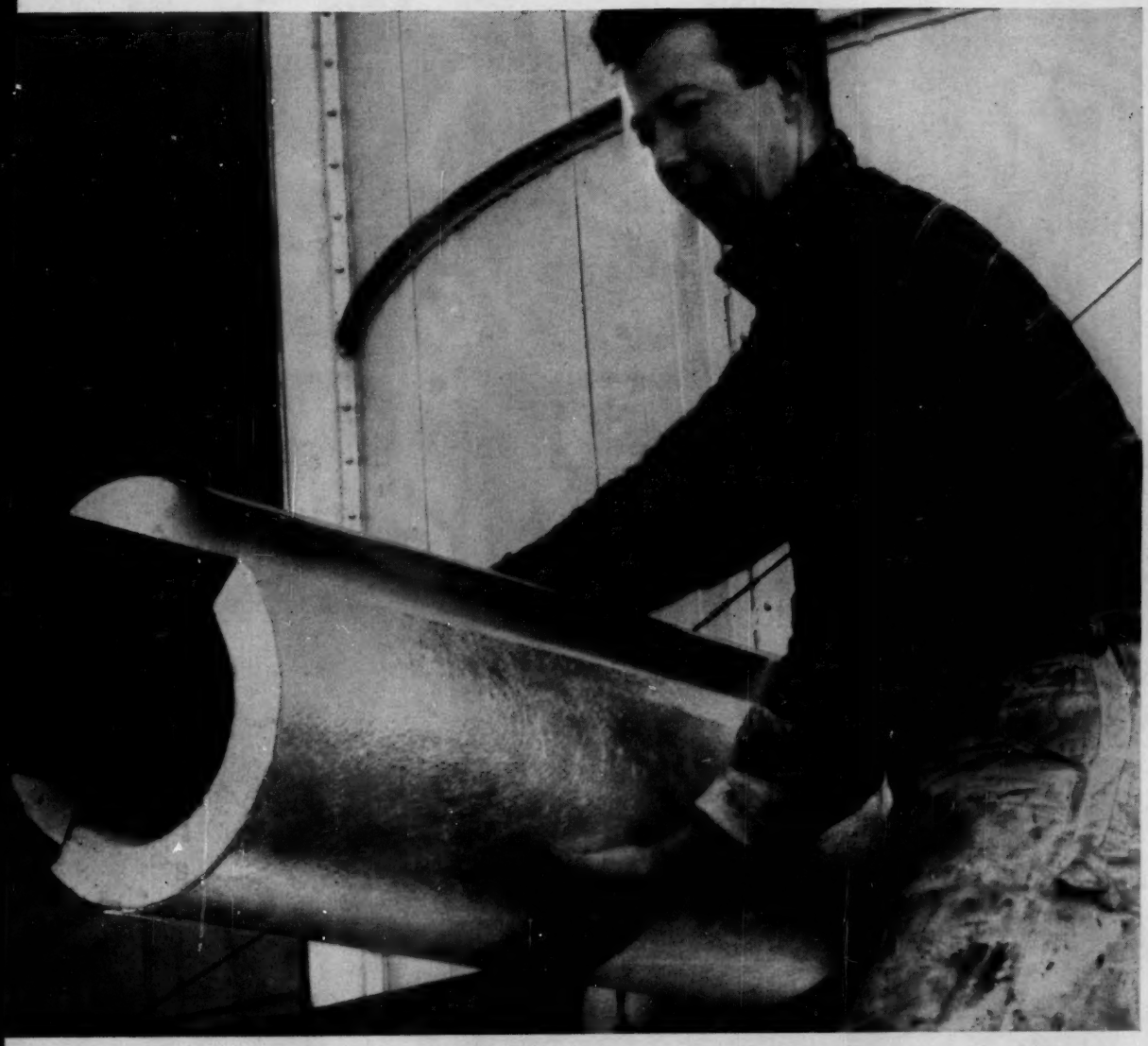


New Fiberglas* KAYLO-KLAD* Pipe Insulation

Now, efficient, high-temperature Kaylo Pipe Insulation comes with an embossed aluminum jacket that locks together in quick, one-step application. New jacket assures full weather protection and adds distinctive "no-glare" appearance.

This is new Kaylo-Klad: the famous efficiency of Kaylo Pipe Insulation factory-jacketed in thick (.016") embossed aluminum. Longitudinal seam of jacket snaps together with interlocking lips for positive weather tightness in one, quick step. End joints are sealed with a band containing an integral sealing compound.

Aluminum jacket provides greater resistance to mechanical damage and embossed, rippled texture diffuses light and eliminates glare, while dressing up line. Kaylo-Klad offers excellent thermal efficiency for temperatures up to 1200°F in all standard sectional pipe sizes and in thick-



nesses to 3". It is permanent, reusable, and fabricates with simple tools. A standard band saw or hacksaw makes quick, straight cuts and a saber saw makes cutouts for fittings and hangers.

New Kaylo-Klad is a superior, high-temperature pipe insulation for your industrial requirements. And remember, under the jacket is *Kaylo, the universally accepted and field proven material with the most desired physical properties for an efficient, durable, high-temperature pipe insulation job. Write for new literature to: Owens-Corning Fiberglas Corporation, Department 55-C, Sales Division—717 Fifth Ave., New York 22, N.Y.

OWENS-CORNING
FIBERGLAS

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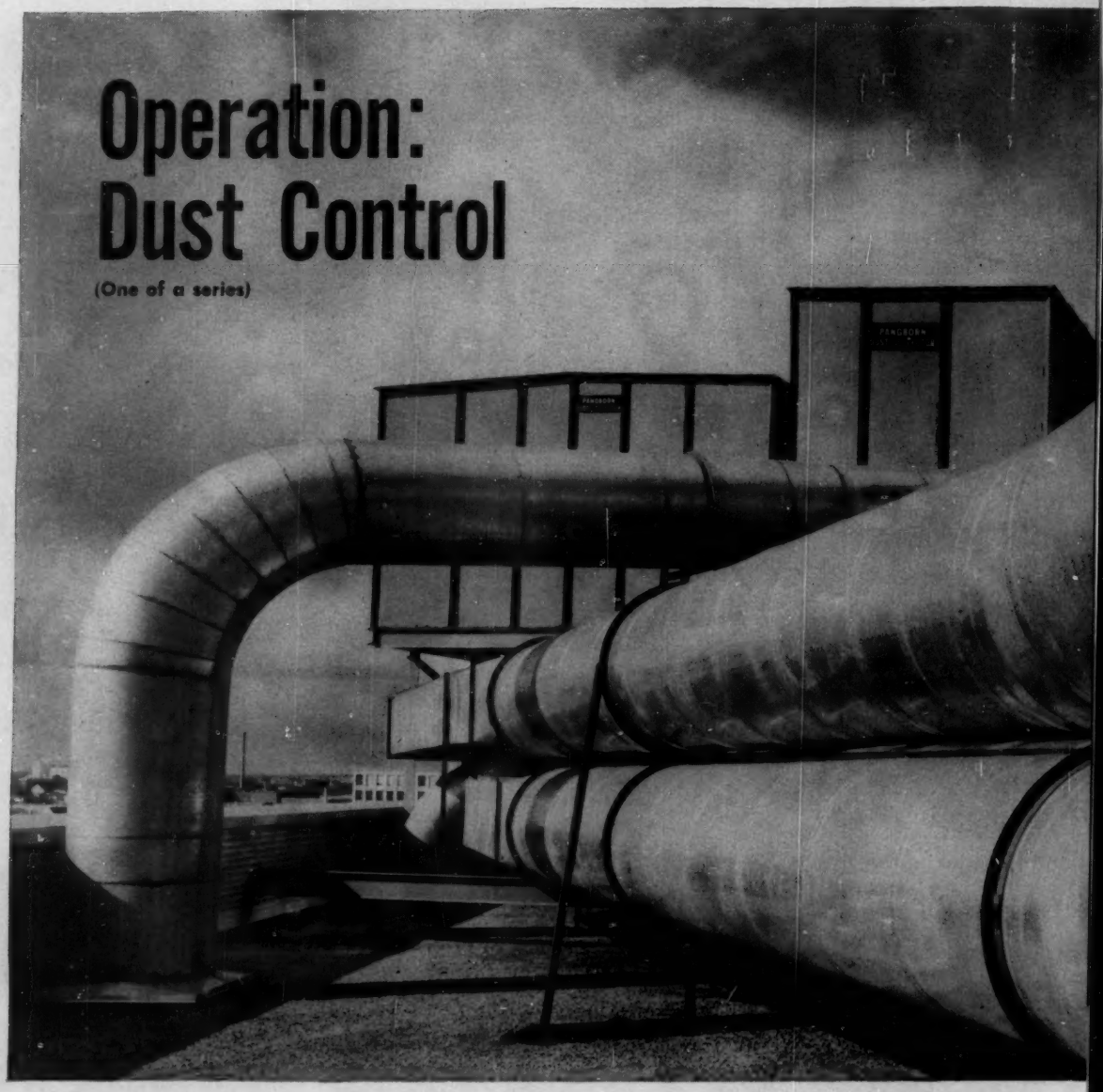
Operation: Dust Control

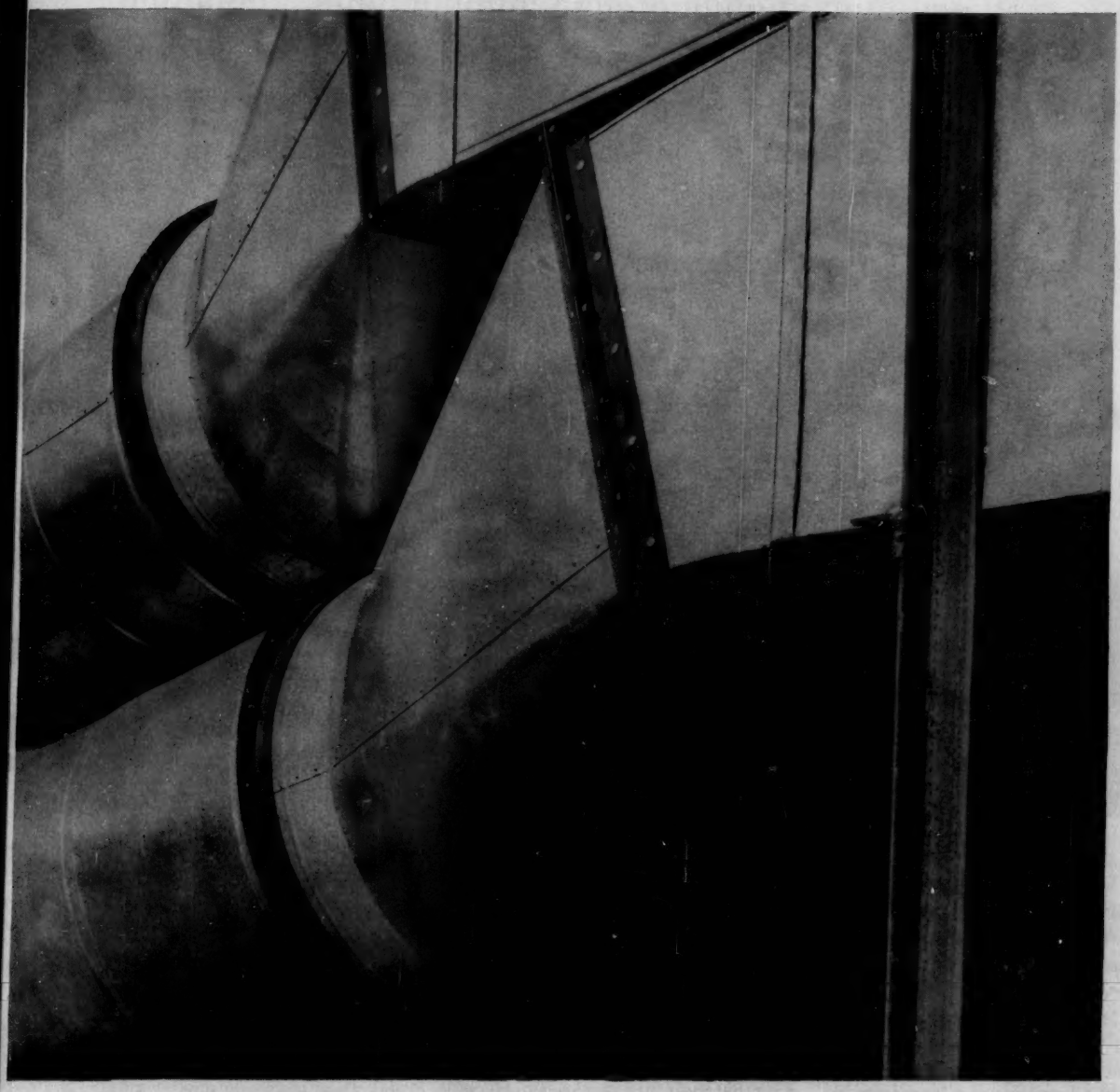
(One of a series)



At National Cash Register, 10 tons of wood

Dust is trapped at the source by hoods engineered for the individual job . . .

. . . and is piped from 160 locations to five giant Pangborn Cloth Bag Collectors.



shavings, chips and dust are collected daily!

Mammoth is the word for the 5-floor woodworking plant of National Cash Register headquarters, Dayton, Ohio. Processing nearly 300,000 sq. ft. of lumber each month, this operation generates 10 tons of waste material per day.

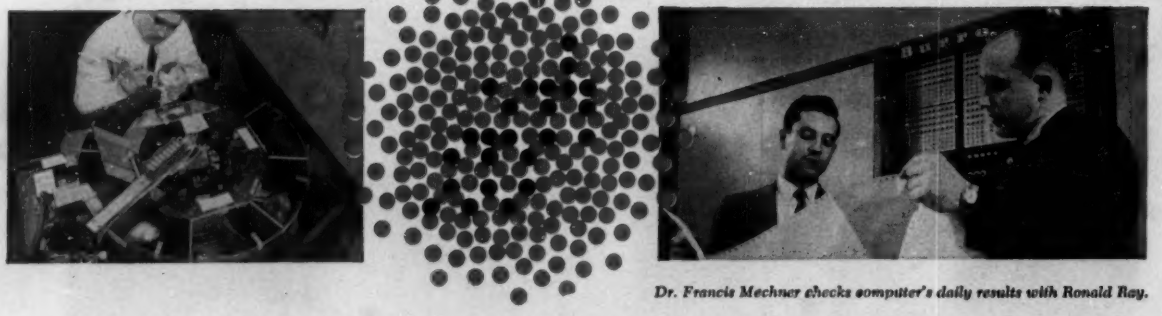
To protect NCR employees, equipment, plant and neighborhood, five Pangborn Cloth Bag Dust Collectors trap 90 cu. ft. of fine dust for disposal and, during the winter months, permit recirculating of the already-heated, cleaned air. This efficient performance of Pangborn Dust Control saves thousands of dollars in heating costs during the cold weather. In addition, a neighborhood and health nuisance has been eliminated; equipment maintenance and plant housekeeping costs have been minimized.

Dust a continuing problem in *your* plant? Talk t the Pangborn man in your area or write: PANGBORN CORPORATION, 2200 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Dust Control, Blast Cleaning, Vibratory Equipment—Rotoblast® Steel Shot and Grit.®*

Pangborn
OF HAGERSTOWN

A Statement from Francis C. Brown, Chairman of the Board and President, Schering Corporation:

"In behavioral research alone, our Burroughs computer has multiplied our productivity by 100 times!"



Dr. Francis Mechner checks computer's daily results with Ronald Ray.

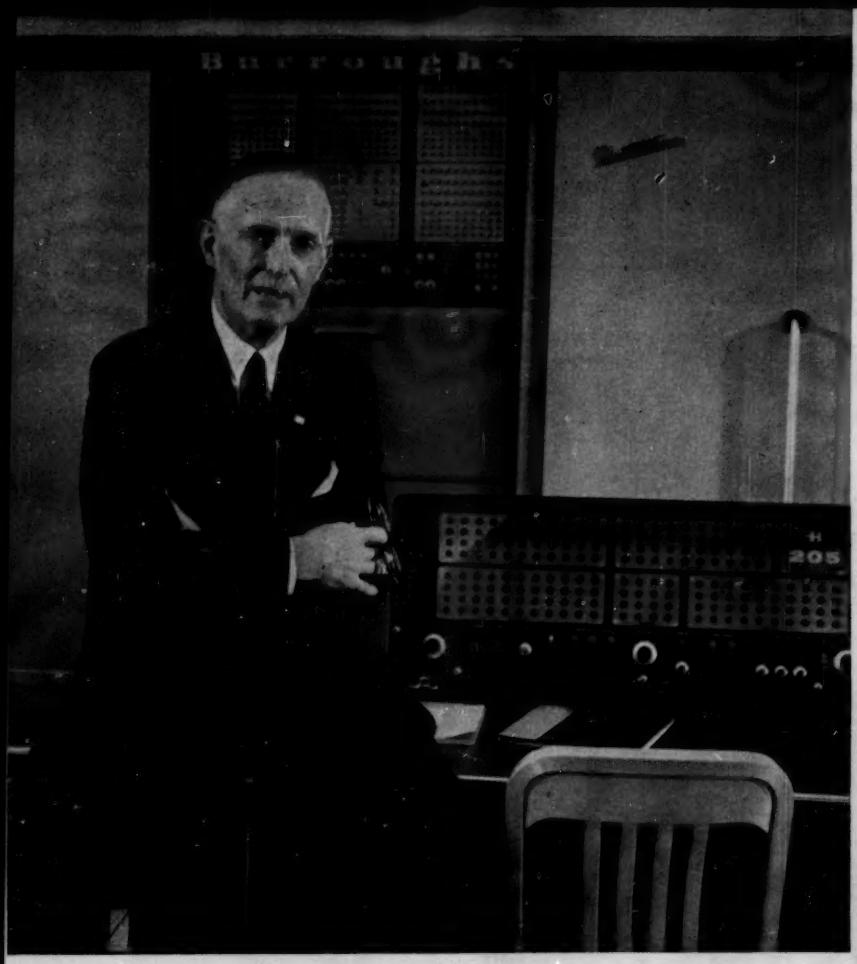
"We, at Schering Corporation, have grown accustomed to miraculous developments in our industry. So many advancements have been made in pharmaceutical research in the last two decades, we are convinced that we may indeed be on the brink of a pharmacological revolution.

"Yet, there is so much more to be done, so many new avenues to explore, that we recognize the only real source of continued development is through expanded research efforts. Through research, Schering has already created several of the world's leading ethical drugs...major emphasis has been on cortical hormones and antahistamines. Some, like Coricidin, have become household words.

"While the results of research are sometimes dramatic, there is little of the miraculous in the day-to-day explorations made by pharmaceutical scientists. For one thing, pharmaceutical research is expensive...costs are over three times more per sales dollar than all other industries and rising substantially each year. Findings are often inconclusive and only a small portion ever reach fruition in a marketable product. And with a diversified line of products such as ours, we must maintain research projects in many different areas simultaneously. Even with the newest and most successful discovery, a competitor may enter the market with a better product that puts yesterday's 'miracle' out of favor.

"Yet, a relentless search for new products is a necessity. It is the only reasonable assurance of the continuing health of our own business enterprise. Today we are conducting extensive experimentation with chemical molecules of known pharmacological properties. The object is to achieve radically new pharmacological results by means of various alterations in chemical structure. Once achieved, these new compounds must be evaluated in laboratory animals. The methodology of this program is exemplified by an experiment carried out in Schering's Behavorial Research Laboratory. Here, eight highly trained rats take their turn in succession night and day, at a testing station where their behavior is recorded and then analyzed by computer. This is the type of experimentation in which the behavorial effects of drugs are tested in animals. The results of these experiments permit predictions concerning the effects these drugs will have on man.

"With thirteen experiments of this type proceeding on a continuous basis, the volume of data generated could never be handled without the aid of a computer. The Burroughs 205 performs computations every day which the staff



PHOTOGRAPHS BY J. ALEX LANGLEY

Dr. Bradley Whitman, Director of Research Services, confers with Gordon B. Thomas, Biometrics Manager.

of Schering's Behavorial Laboratory would require years to complete. The computer's final output is in the form of tables and graphs which are then studied and interpreted by psychopharmacologists.

"The decision to install a Burroughs 205 computer was upheld by a need to provide rapid, complete and economic analysis of the data which is produced by the research division at great cost. We investigated the computer field thoroughly, and after careful study and professional consultation, our technical people believed no other computer met our requirements so well. One of our scientific programmers, Biometrics Manager Gordon B. Thomas, was particularly impressed with the 205's ability to handle large masses of data with the power of a large scale computer... and at less than half the cost. Mr. Thomas felt the 4000-word memory of the 205 greatly facilitated the execution of research programs, many of which exceed 10,000 steps.

"In our research projects alone, the 205 has earned its keep. Dr. Bradley Whitman, head of Research Services, reports our 205 computer is turning out fast, accurate results at a cost we could never have realized by any other method. Research scientists are freed from time-consuming data collecting and may now spend more time on creative work.

"In addition to serving as a research aid, our 205 has provided us with other benefits as well.

"Our Procedures Department Manager, William B. Spencer, points out that the 205 is completely compatible with our commercial needs as well as research. In fact, our recent purchase of additional Burroughs peripheral equipment will allow us much greater capacity for commercial applications.

"As we expand and broaden our search for new products, we expect commensurate growth in other areas of our company as well, and we are confident that our 205 computer, with its modular expansion features, will keep pace with our computing needs."

FRANCIS C. BROWN
Chairman of the Board and President
Schering Corporation

Hundreds of other scientific and commercial users of Burroughs computers are confirming the same experience. Burroughs complete line of electronic data processing equipment is backed by a coast-to-coast team of computer specialists, all eager to tell you how Burroughs can help in your business. For additional information, write ElectroData Division, Pasadena, California.

Burroughs Corporation

"NEW DIMENSIONS/in electronics and data processing systems"

No alignment worries! LINK-BELT bucket elevators go

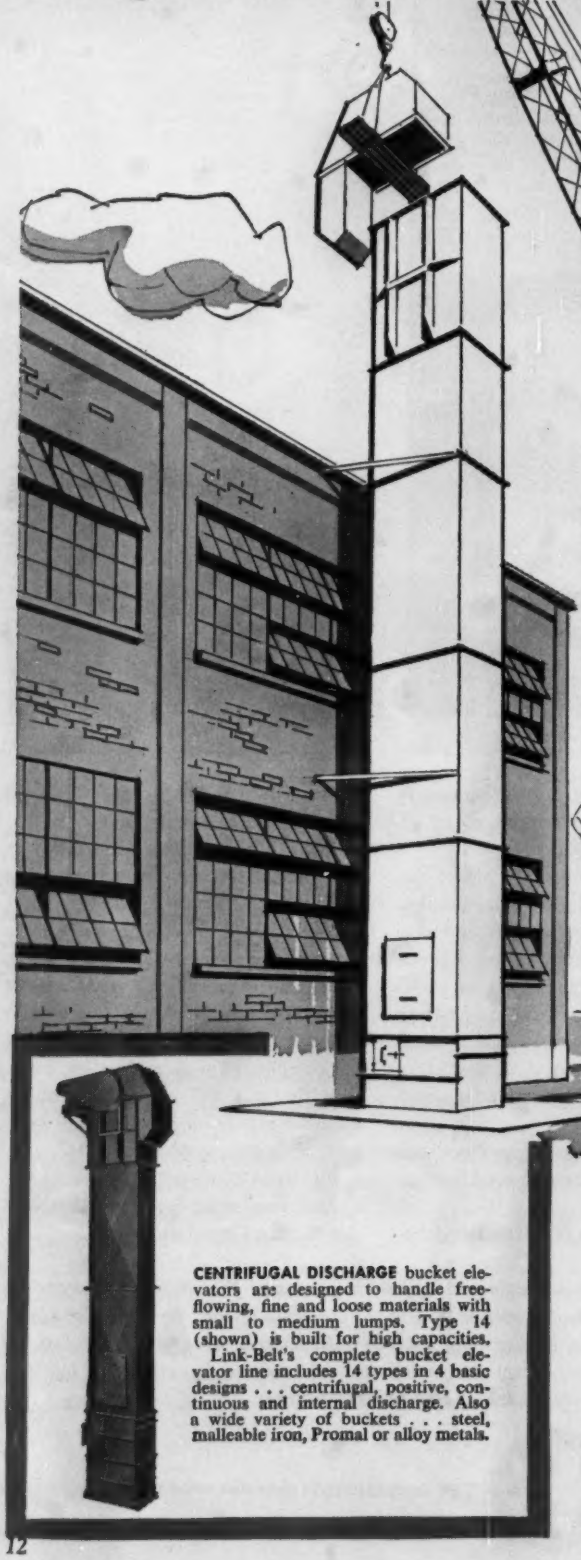
straight up... fast and easy

Factory-aligned components assure low-cost installation, smooth performance

Yes, Link-Belt bucket elevators go up easy . . . and they go up *straight!* There's no misalignment to cause inefficiency, bucket and casing wear.

Link-Belt manufactures *all* bucket elevator components . . . eliminates installation and operational problems in the *factory,* not in the field! All components are carefully designed and manufactured. Casings are jig-welded for perfect, ready alignment. Result: Unnecessary erection costs and difficulties are avoided, long-lasting efficiency assured.

Link-Belt will gladly erect your elevator (large or small) and accept full installation responsibility. For details, contact your nearest Link-Belt office. 15,307



CENTRIFUGAL DISCHARGE bucket elevators are designed to handle free-flowing, fine and loose materials with small to medium lumps. Type 14 (shown) is built for high capacities.

Link-Belt's complete bucket elevator line includes 14 types in 4 basic designs . . . centrifugal, positive, continuous and internal discharge. Also a wide variety of buckets . . . steel, malleable iron, Promal or alloy metals.

LINK-BELT

BUCKET ELEVATORS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses and District Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World.

HACKNEY STAINLESS STEEL DRUMS
Noncontaminating . . . re-usable . . . economical

For safe, contamination-free handling of acids, essential oils, solvents, perfumes, various viscous materials, food concentrates and many other chemical preparations. Hackney drums are available also in Monel, Inconel and nickel. Features of Hackney protective alloy drums include:

- 100% smooth interiors—no place for germs, foreign matter to hide.
- High resistance to corrosion...protection against chemical changes.
- Metals that cannot impart flavor to contents of drum or discolor it.
- Seamless chime construction that makes bottom stronger and easier to keep clean.
- Availability of drums with and without rolling hoops.
- Choice of drums in 30- and 55-gallon capacities—with removable heads; with tight heads, 55 gallons.

For full specifications—in stainless, Monel, Inconel and nickel—write to the address below.

Insert shows detail of Hackney seamless chime construction

Pressed Steel Tank Company

Manufacturer of Hackney Products

1447 South 66th Street, Milwaukee 14, Wisconsin

Branch offices in principal cities

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

NEW

GENERAL PLATE PLATINUM-CLAD MATERIALS

Relative thickness and construction of platinum-clad stainless steel crucible and dish. Steel layer is 0.033 inches thick. Platinum 0.002 inches. The platinum layer is rolled over at the top to cover the base metal at the pouring edge to prevent contamination.

STRIP — rolled in thicknesses from 1/16 to .001 inches; widths up to 12 inches. Platinum thickness can range from .0001 to .005 inches.

TUBING — clad inside, outside or both. O.D. 1 inch max.; to .016 inches min. Varying wall thickness to .004 inches min.

WIRE — solid platinum or alloy wire from .001 inches min.; to 1.00 inch maximum O.D. Platinum clad to titanium, stainless steel, nickel, etc. Down to .003 inches diameter with platinum thickness to .0001 inches.

...enables users to cut costs by up to 80% over solid platinum ware, strip, tubing and wire

Now, users of expensive solid platinum crucibles, dishes, strip, tubing and wire used in corrosive atmospheres *can substantially cut material costs* with General Plate Platinum-Clad Materials (stainless steel, tantalum, titanium, nichrom, nickel, etc.).

Compare These Advantages:

Acid Resistant — Resistant to all reagents used with solid platinum.

Greater Durability — Less susceptible to external wear and mechanical damage . . . needs less care in handling.

Uniform Platinum Layer — Varies less than 0.0001 inches... assures even resistance to wear.

Extra Hardness — 0.5% Rhodium content adds hardness and retards grain growth.

Sound Metallurgical Bond — The two metals are permanently clad by a patented solid-phase bonding process. No brazing alloy or intermediate material is used . . . objectionable voids, oxides and inclusions are eliminated.

Find out how you can benefit by using General Plate Platinum-Clad Metals. Write for Bulletins PLA-1, PLA-3, PLA-5, today.

A photo-micrograph at 500X magnification shows the uniformity of the platinum layer resulting from the solid-phase bonding process used to clad the platinum alloy to the stainless steel. It can also be observed that no diffusion of the two metals into each other took place during processing. The composite metal is metallurgically bonded by this patented process without the use of a brazing alloy or other intermediate material.

This is a photo-micrograph at 500X magnification of the same material, as shown above, after it has been subjected to a constant temperature of 1550°F. for a period of one month (720 hrs.). A relatively small percentage of the total platinum layer has alloyed with the stainless steel. This amount of diffusion is allowable and will not affect the performance of the clad-metal laboratory-ware.

OTHER PLATINUM PRODUCTS

Solid & Clad Sheet | Solid & Clad Wire | Solid & Clad Tubing | Catalysts, Salts and Derivatives

METALS & CONTROLS DIVISION
Platinum Products Group

- Assays and refines platinum-group metals
- Recovers and reworks materials previously expended in use
- Alloys platinum-group metals
- Produces chemical compounds for catalysts and for electroplating solutions
- Produces solid and clad metals as sheet — foil — wire — tubing — gauze
- Fabricates electrical contacts and contact assemblies for switches, relays, instruments, controls and other applications; thermocouple wire and other parts — all to exact customer specifications

TEXAS INSTRUMENTS
INCORPORATED
METALS & CONTROLS DIVISION
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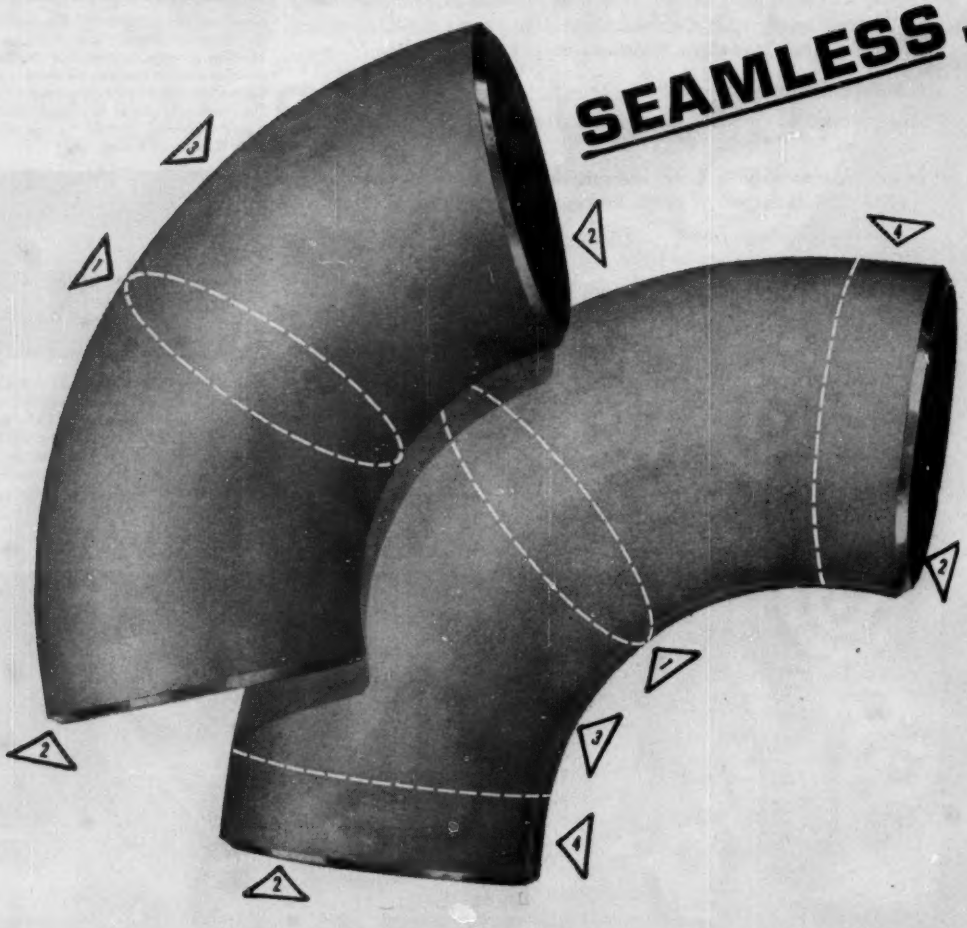
General Plate Products: Clad Metals • Electrical Contacts • Truflex®—Thermostat Metal
Gold, Silver, Platinum and other Precious Metal Products

NOW...BOTH!

SEAMLESS..



1. BONUS... All fittings hot-coined in compression throughout entire length—dimensionally true to permit segmenting at any point. **2.** BONUS... Seamless and welded-type fittings with specially machined ends assure uniform thickness and diameters . . . ends that are circle-perfect, plumb and square. **3.** BONUS... Wall thickness and uniformity—greater than required by ASA Standards. **4.** BONUS... Long Tangent bonus on welded-type fittings—NO EXTRA COST—saves pipe, simplifies lining-up, eliminates short welded stubs.

BY MIDWEST

NEW! The finest *seamless* welding fittings ever made. NOW—a hot-coined fitting, dimensionally accurate from end to end . . . fittings forged at controlled heat for superior metallurgical quality . . . with specially machined ends for quickest fit-up and welding! Produced by the newest and most modern equipment—combined with the latest technology in forging, sizing, heat-treating, and machining. Available in all sizes through 24"—long radius or short—90's, 45's, 180's.

WELDED . . . BY MIDWEST

Welded-type fittings, fully reinforced . . . especially "Long Tangent" bonus fittings . . . always available from stock in carbon steel through 36" (to order through 48")—same high quality as always. Also available from stock in wrought iron and chrome-moly. Fittings formed from plate and welded are ideally suited to unusual requirements—heavy wall (2", 3", 4" or more) . . . Hi-Yield, Inconel, stainless, Hastelloy and all other weldable metals. Extra tangent lengths, reducing ells, and special fittings of all kinds are made best as welded-type fittings.

THE WORLD'S MOST COMPLETE LINE OF WELDING FITTINGS
. . . sold through stocking distributors from coast to coast.

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FITTINGS, No. 60-C

PIPING COMPANY, INC.
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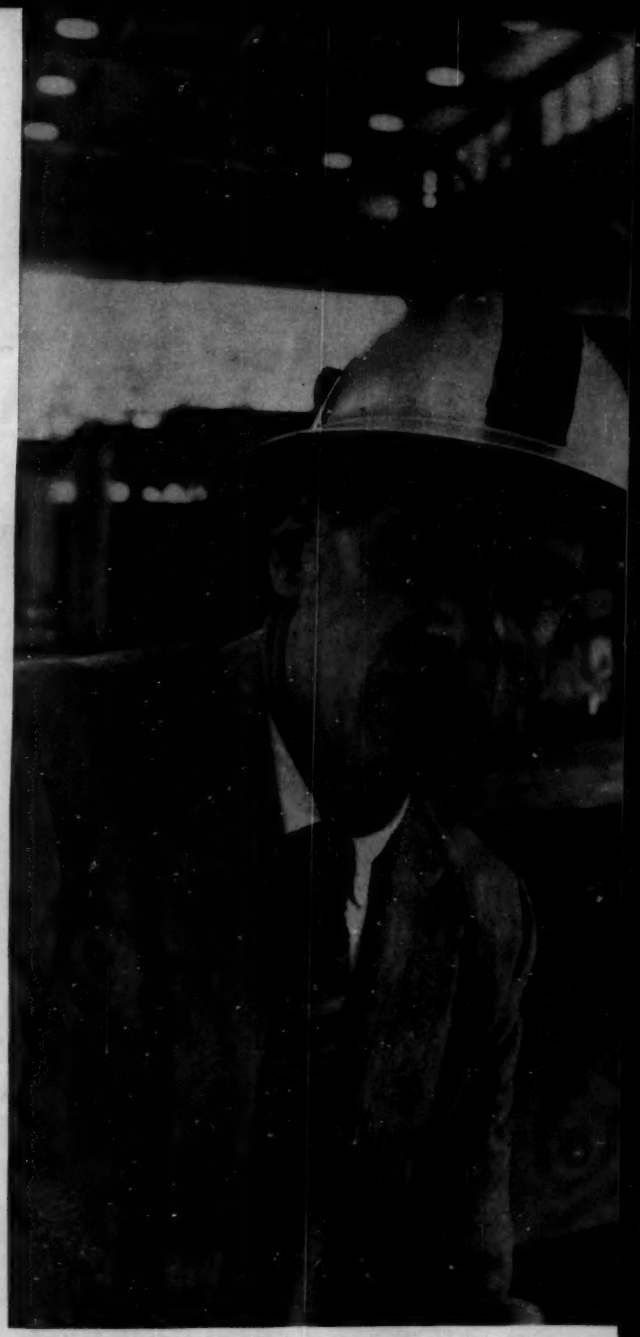
Report from Tidewater...

How Cooper-Bessemer hydrogen boosters supply 800 psi 'round-the-clock



At Tidewater Oil Company's refinery south of Wilmington, Delaware, two Cooper-Bessemer FM-2 compressors play a vital part in the hydrogen treatment process by which the refinery upgrades a number of products and intermediate fractions. These hydrogen boosters operate 24 hours per day, boosting 690 cfm of hydrogen at 470 psi to a discharge of 800 psi. This hydrogen is delivered directly to the desulfurizers.

These Cooper-Bessemer compressors have performed well under this heavy-duty service. Maintenance costs and outage time have been low.

The customer is also pleased with the performance of three Cooper-Bessemer air compressors which supply utility air to the entire refinery on a 24-hour, 365-day per year basis.

Find out how Cooper-Bessemer products can help assure dependable compression and optimum economy for *your* processing. Call our nearest office for help in planning of your facilities.

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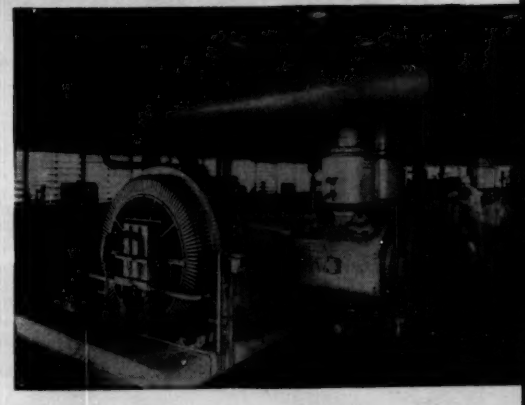
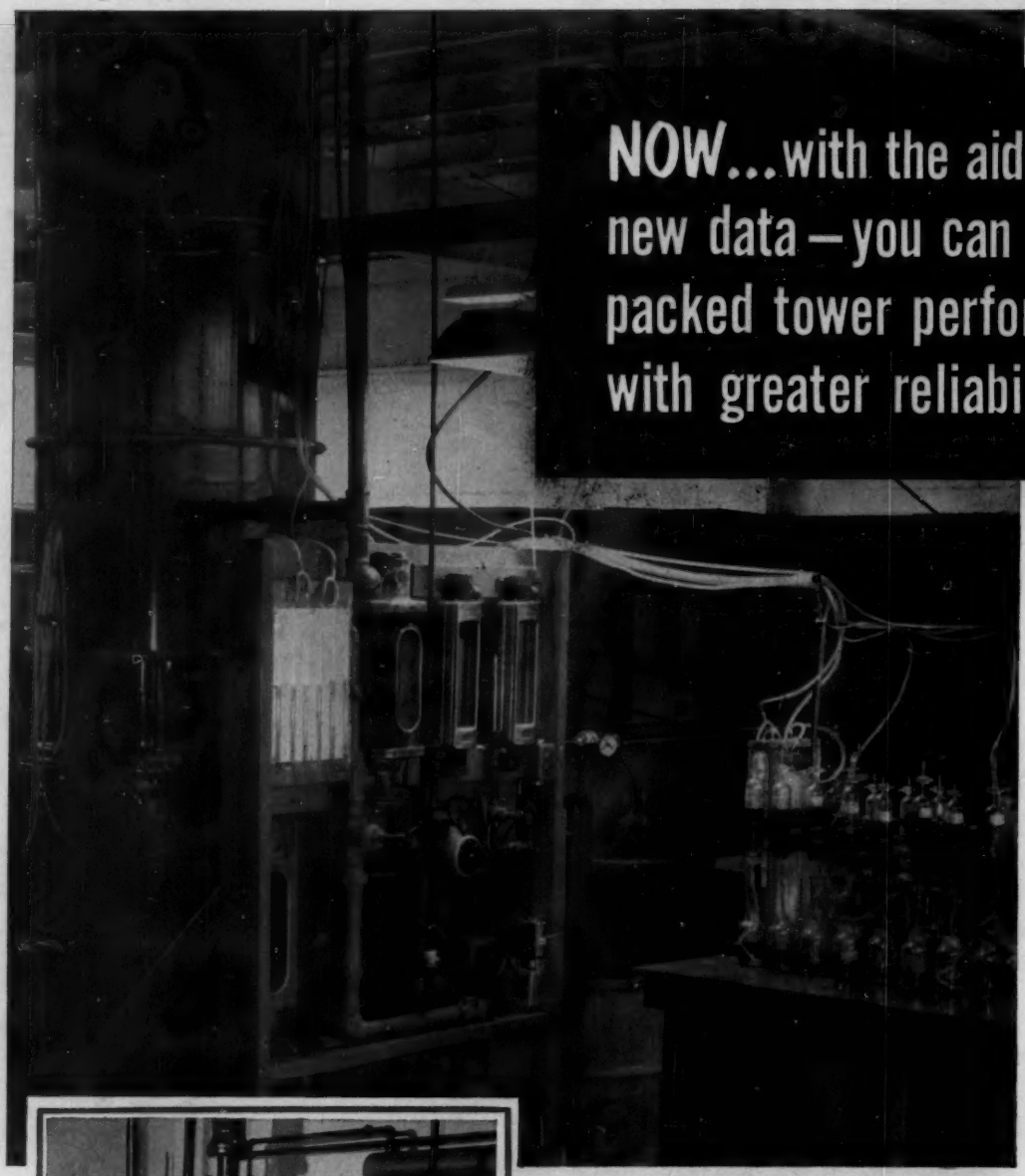
Cooper-Bessemer FM-2 Hydrogen Compressors at Tidewater Refinery. Rated 690 cfm, suction 470 psi, discharge 800 psi.

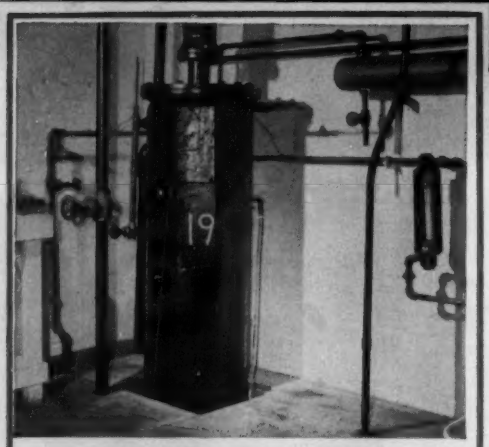


Three Cooper-Bessemer Air Compressors at Tidewater. They supply utility air at about 120 psi for processes throughout the refinery.

NOW...with the aid of this new data—you can predict packed tower performance with greater reliability



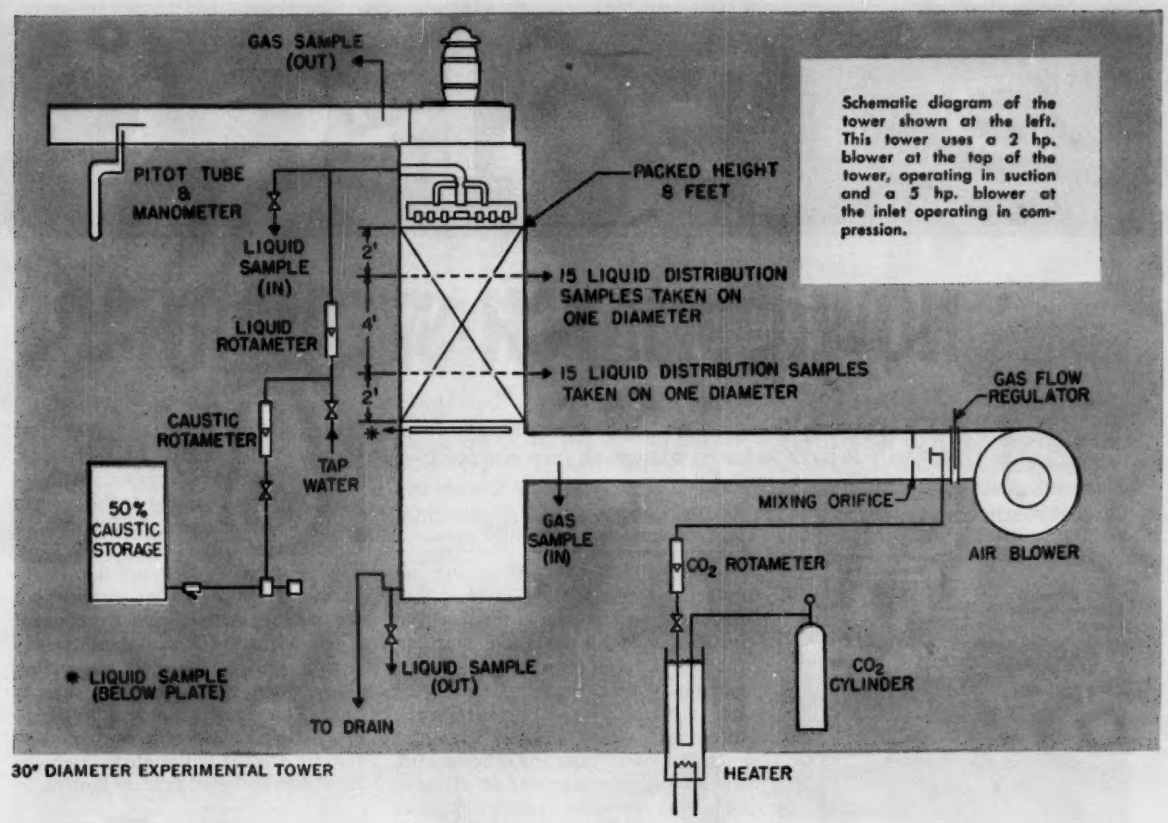
One of the 30" diameter experimental towers used to accumulate gas mass transfer coefficients and pressure drop data on tower packings of various types and sizes.



A view of the upper section of the fifteen foot high, 24" diameter distillation tower in U. S. Stoneware's Engineering Laboratories.

159-G

Up to a few years ago, data on packed columns sufficiently reliable to enable design engineers to predict performance in specific applications was virtually non-existent. Each new packed column installation had to be designed afresh, and was usually over designed to provide an adequate margin of safety. Data reflecting the experiences of plants operating towers of industrial size was generally not available; published data reflecting the work of universities conducted in small experimental towers, (because of limited availability of funds) while helpful, left much to be desired when used for scale-up.



Schematic diagram of the tower shown at the left. This tower uses a 2 hp. blower at the top of the tower, operating in suction and a 5 hp. blower at the inlet operating in compression.

30" DIAMETER EXPERIMENTAL TOWER

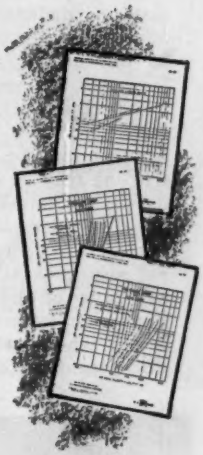
The development of high capacity tower packings such as the Intalox Saddle® and the Pall Ring brought with it the need for data that could be used to predict with reasonable accuracy the performance of large size towers.

Accordingly, The U. S. Stoneware Co., began building some four years ago a series of experimental towers of such size that data obtained from their use could be accurately translated in specific terms and could be used to predict the performance of large towers with reasonable accuracy.

In these past four years we have conducted hundreds of tests involving various types of tower packings, distributors, packing support methods, in absorption, fractionation, stripping and distillation. Test runs have been repeated over and over again to be sure that the data obtained would reliably indicate what could be reasonably expected.

Data obtained from these tests have been used by our engineers in designing towers up to many feet in diameter and performance of the completed tower has almost invariably equalled or exceeded anticipated performance.

This data is now being released for general distribution to chemical engineers everywhere without cost or obligation. The first release covers more than fifty graphs showing performance of various packings with data reflecting capacity and efficiency, etc. If you would like to receive a set and be placed on our mailing list for future releases as they occur please write us on your company letterhead. They will be sent to you promptly.



PROCESS EQUIPMENT DIVISION

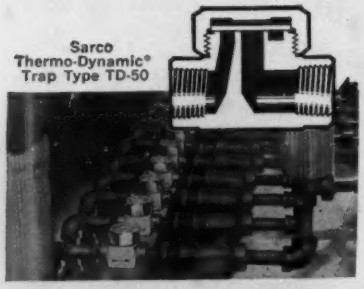
U. S. STONEWARE
AKRON 9, OHIO

159-G

SARCO

NOW...MATCH STEAM TRAPS

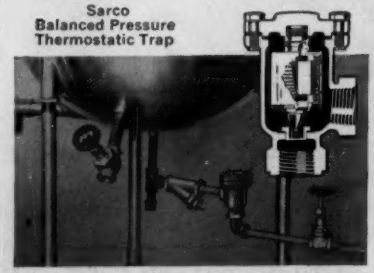
THERE'S no such thing as an all-purpose steam trap. That's why it pays to know what each trap has to offer. Here are five examples that demonstrate how you can match the correct steam trap type to the exact requirements of *each* application.



EXAMPLE 1: Outside Tracer Lines: A tough set of requirements

One of the most demanding sets of requirements a steam trap has to face is found in *outside steam tracing*. The trap must not only rid tracer lines of condensate and air immediately they're formed, but it must do so under exacting conditions. Pressures on each trap may vary widely. Installations may be remote and inaccessible to service. Water hammer may be a constant threat; freezing may be a hazard. Only the unique Thermo-Dynamic trap takes all these demands in stride. The Sarco TD-50 operates perfectly *without adjustment* through its full pressure range of 10-600 psi. It's virtually immune to water hammer and won't freeze when installed with a free discharge. Maintenance is, therefore, negligible. Compact, requiring no external support, the TD-50 is just about the easiest trap in the world to install. Once it's installed, you can forget it. You can count on an extremely long, trouble-free service life with minimum maintenance attention.

More closely than any other model, the TD-50 approximates an all-purpose trap. However, special application requirements might dictate the use of another type of Sarco trap. Sarco engineers stand ready to help you solve any trapping problems.



EXAMPLE 2: For steam jacketed process kettles: a trap that operates immediately on start-up and self adjusts to both low and high pressures

When a large steam-jacketed process kettle starts up, the condensate load is high, and all air in the jacket must be released quickly. At this stage, however, the jacket pressure is low; yet it builds up rapidly as the process continues. Because a SARCO No. 9 Balanced Pressure Thermostatic Trap is wide open on start-up, it releases initial air and condensate without the need for a bypass. And because it is self-adjusting, it works just as efficiently during the first processing stage when the jacket pressure is high. There are no seats to change for various working pressures. You can see why it is the obvious choice for steam jacketed process kettles.

EXAMPLE 3: How to prevent water-logging in unit heaters and blast coils

All unit heaters and blast coils have a relatively small internal volume in comparison with their steam condensing capacity. Even slight water-logging can reduce heat output seri-

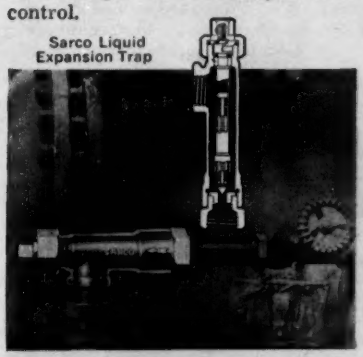
Impartial advice on trapping because
ONLY SARCO MAKES ALL 5 STEAM TRAP TYPES

TOPICS

SARCO

TO YOUR TRAPPING NEEDS

ously. Pressures may vary widely under automatic temperature control and so may the load because of variable demand. A trap to handle this application must adjust itself instantly to pressure and load charges. The most precise answer to this problem is the SARCO Float and Thermostatic Trap—and here's why: it releases air on start-up and during running, and, because it discharges condensate continuously, it does not set up in the system violent pressure changes that would upset close control.

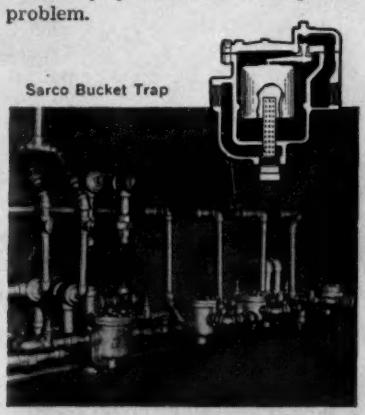


EXAMPLE 4: How to release low temperature condensate

When condensate cannot be returned to the boiler feed tank either because of distance or because it may be contaminated, it's economical to utilize some of the sensible heat as well as the latent heat of the steam.

For this purpose a trap must be capable of releasing condensate to temperatures as low as 100° F.

The sound trap selection here is the SARCO No. 871 Liquid Expansion Trap because it can be set to release condensate at temperatures down to 100° F. regardless of supply pressure. This performance assures maximum steam economy. The Sarco No. 871 handles the starting load easily because of its wide open valve, which throttles the flow as the condensate temperature rises. Furthermore waterhammer cannot reach the operating element. No other type is as nearly perfect for this specific problem.



EXAMPLE 5: Economic handling of Water Hammer and Corrosive Conditions

In applications in which water hammer or corrosive conditions are encountered but in which low pressures or extremely high back pressures preclude the use of the Thermo-Dynamic trap, the Sarco Inverted Bucket Trap is recommended. While the Sarco I. B. is not exactly a fuel miser, its relatively rugged construction will withstand considerable water hammer; and, when it is fitted with stainless steel internal parts, it offers excellent resistance to corrosion.

* * *

CONCLUSION: The right application is the economical installation

When you choose steam traps that serve their purpose without frequent adjustment, and without maintenance or replacement problems, you save on down-time, man-hours, spare parts, and production slowdowns.

You can get the money-saving solution to every trap selection problem by consulting Sarco. You get impartial solutions, because only Sarco makes all 5 types of steam traps: Thermo-Dynamic*, Thermostatic, Float Thermostatic, Liquid Expansion, and Bucket.

You also get the benefit of Sarco's 50 years of specialized experience in the manufacture and application of temperature regulators, industrial air vents, pipeline strainers, dial and industrial thermometers, heating and cooling controls, heat exchangers, heating control systems and heating specialties.

For literature or impartial help in solving your steam trapping or control problems, contact your local Sarco Sales Representative, or write direct to Sarco. 1440

*U.S. Pat. No. 2,817,353. T.M. Reg. U.S. Pat. Off.

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AMERICAN BI-METAL THERMOMETERS make accurate temperature readings sharp and sure at all check points

American Dial Thermometers are also available in mercury, vapor pressure, and gas actuation . . . on-the-spot and distant reading types . . . in sizes, ranges and stem lengths to meet your most exacting requirements.

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Any way you look at an American Bi-Metal Thermometer, you see exact working temperatures.

The two-level "Maxivision®" dial eliminates parallax effects. Numerals are on the lower level. Graduations are on the outer raised ring dial which presents a sheared edge to the tip of the pointer and in the same plane. To make readability even more accurate, the glass and graduated dial are closely spaced.

American Bi-Metal Thermometers are made of weather-proof stainless steel. All joints are welded to solid unity, then polished smooth so corrosion won't build up and destroy the thermometer's usefulness. And, you don't have to discard this thermometer even if the glass is ever broken. The bayonet lock bezel makes replacement easy.

Learn about the high sustained accuracy and long service life built into American Bi-Metal Thermometers. Phone your nearby industrial supply distributor for help in selecting the right type for each temperature check point in your plant. Or write for Catalog 100A.

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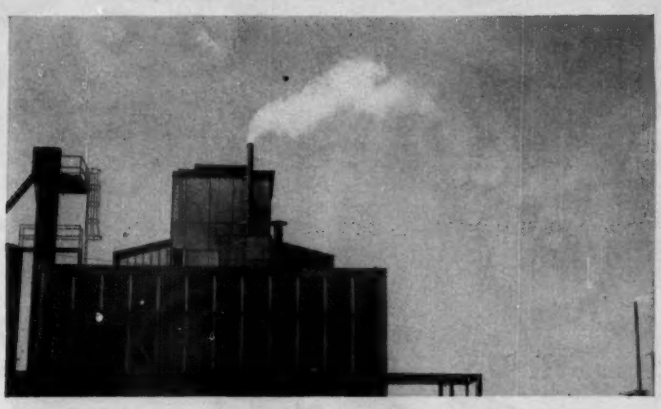
Before scrubber was installed —visible cloud is composed largely of water with about 0.5% sulfur trioxide

THE CHEMICO VENTURI SCRUBBER MAKES THE BIG DIFFERENCE



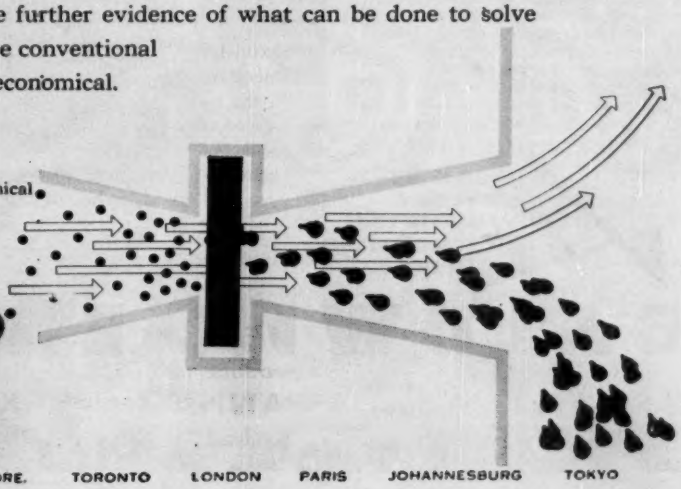
After scrubber was installed— water vapor has diminished considerably, sulfur trioxide content is practically nothing

With sulfur trioxide fumes being vented to the air in a thick vapor fog, Ansul Chemical faced an air pollution problem common to many chemical producers. They were willing and anxious to comply with community requests for pollution control, but they were unable to find a scrubber which could rid the stack of both the water vapor and the SO_3 as well.

While virtually any scrubbing device was capable of removing the water vapor, only the Venturi scrubber was effective in removing the acid fumes. By removing all but the last traces of SO_3 the Venturi scrubber gave further evidence of what can be done to solve really tough gas cleaning problems where conventional cleaning devices prove ineffective or uneconomical.

FULL DETAILS AVAILABLE

For your copy of a brochure giving complete data on Chemico Venturi gas scrubbers, or for technical assistance on a specific problem, write to Chemico at the address below.



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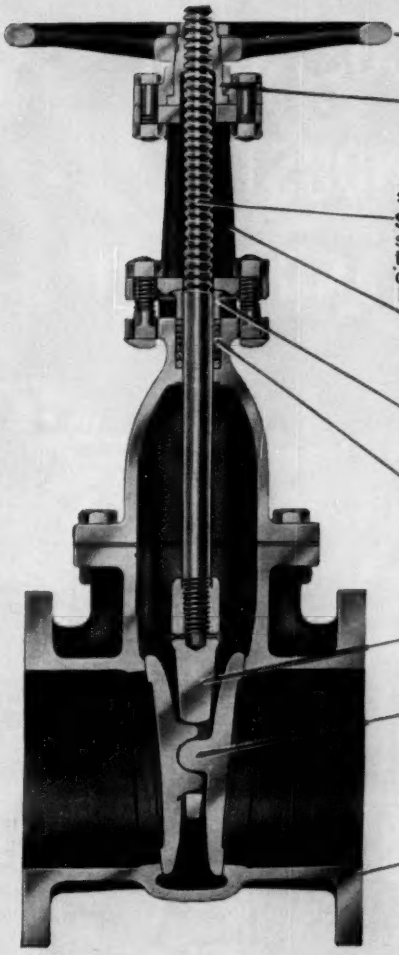
This picture shows the many points of excellence in the design and construction of Jenkins Fig. 1327 Split Wedge Stainless Steel Gate Valves. Compare them with any valve you know. You'll conclude that it's hard to beat Jenkins at making valves, no matter what the material.

But no picture can show the quality of the castings . . . the precision machining . . . the rigid inspection and testing that have gone into this valve. All of these are as important as design and metal alloys in assuring long, dependable, economical valve service. And, all of them are up to the peak standards for which Jenkins has been known for almost a century.

SEND FOR NEW CATALOG of Jenkins Stainless Steel Valves. You'll find in it the patterns you want, in a choice of alloys that satisfy the requirements of practically all corrosive services. Also, you'll see that these Jenkins valves meet valve industry specifications and the high standards established by the leading users of stainless steel valves. Jenkins Bros., 100 Park Avenue, New York 17.



WHEEL of high strength malleable iron designed for firm grip and easy operation.

YOKE BUSHING, easily renewable. Made of bronze, for ideal thread engagement with stainless steel spindle, to prevent seizing or galling of spindle threads. Bushing of stainless steel is optional.

SPINDLE has long thread bearing surfaces with correct lead for easy, tight closing. Screws into wedge carrier, then secured by a stainless steel pin.

YOKE BONNET has liberal space between yoke arms for easy access to packing box. Precision machined flange face assures uniform contact with gasket for a tight body-bonnet joint.

GLAND consists of two pieces — gland flange and gland follower — eliminates binding of follower in case gland bolts are tightened unevenly.

PACKING of Chevron-type Teflon in large packing box prevents leakage. Only a minimum load is required on gland, extending service life of packing.

WEDGE CARRIER connects wedge to spindle and raises or lowers it. Husky in size to stand any operating strains.

SPLIT WEDGE is the ball-and-socket design which automatically adjusts to the tapered seating surfaces for positive shutoff. The discs, revolving freely in the wedge carrier, produce a self-cleaning action on seating surfaces and reduce possibility of galling and seizing.

BODY —Through-port design for full, free flow. Ample wall thickness and good design provide extra strength to withstand stresses. End flanges conform to M.S.S. specs.

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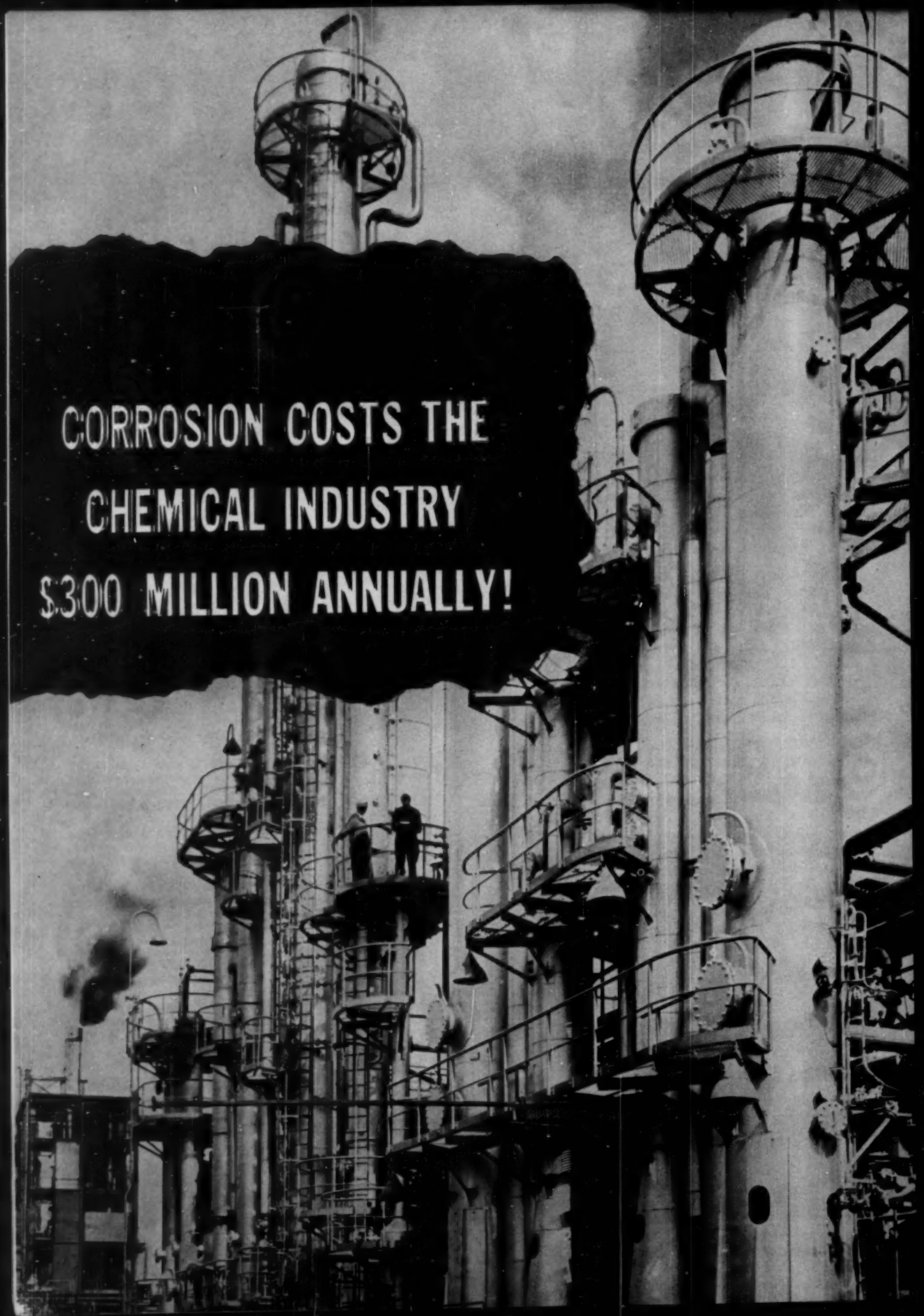
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CHEMICAL INDUSTRY
$300 MILLION ANNUALLY!

...Now You Can Control 88% of All your Chemical Corrosion Problems with this Proven PITT CHEM® Coating System!

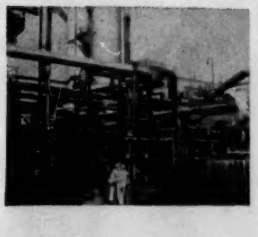
Probably no other industry in the nation is confronted by the variety and severity of corrosion conditions faced each day by the chemical processing industry. Corrosion engineers estimate that the annual toll in equipment and plant facilities is nearly one-third of a billion dollars.

Pittsburgh now provides the chemical industry with a complete *system* of PITT CHEM heavy-duty protective coatings which will efficiently and economically control nine out of every ten corrosion conditions in your plant —from simple atmospheric corrosion to severe chemical attack. Service-proven PITT CHEM cold-applied coatings are now "on guard" in hundreds of chemical processing plants, adding years of valuable service life to storage tanks, piping systems and other equipment where "impossible" corrosion conditions once existed.

PITT CHEM Tarset, Tarmastic and Insul-Mastic are tough, *thick film* coatings that outlast conventional maintenance paints 10 to 20 times. You measure their protection in *decades*, not years. They can be cold-applied by brush, spray gun or roller. No other system of protective coatings can solve so *many* of your corrosion problems so *economically*.

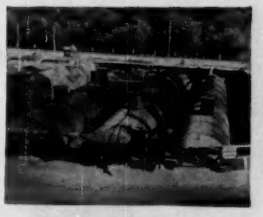
For more information, mail the coupon below. Then consult your nearest PITT CHEM Distributor—he's listed in the "Yellow Pages." Or call Pittsburgh Coke & Chemical Co. in Pittsburgh, New York, Chicago, Houston or Los Angeles. A PITT CHEM Corrosion Engineer will discuss your corrosion problems without obligation.

PITT CHEM TARSET®



The original, patented coal tar-epoxy coating, Tarset is now solving many of the severest corrosion problems in the chemical industry. Years of service as lining for acid and alkali tanks, and on piping and structural steel, have proven the revolutionary ability of Tarset to withstand extreme chemical corrosion.

PITT CHEM TARMASTIC®



PITT CHEM Tarmastic coal tar coatings are a series of thick-film protective coatings designed to solve a wide variety of corrosion problems at moderate cost. Excellent for protection of hoods, fans, housing and other equipment against steam and very corrosive vapors, mild acid and alkaline solutions and extreme moisture conditions.

PITT CHEM INSUL-MASTIC®

Vapor and moisture penetration problems are solved economically and effectively with time-tested Insul-Mastic Gilsonite-asphalt coatings. Ideal for the protection of metal, concrete and masonry surfaces against weather, moisture and many chemicals and vapors. Insul-Mastic cork mastics provide good insulating qualities and condensation control.

PITT CHEM PIPELINE ENAMELS

For the long-term preservation of underground pipelines, coal tar enamels are considered the most practical and effective method of protection ever developed. PITT CHEM Pipeline Enamels are widely recognized for their excellent quality and service record on oil, gas and water transmission and distribution lines throughout the nation.

Send for Your Free Copy of this CHEMICAL CORROSION DATA FILE

Includes a survey of corrosion problems in the Chemical Industry, data on PITT CHEM Coating Systems and a coating selector guide. Write for your copy today.

Name_____ Title_____

Company_____

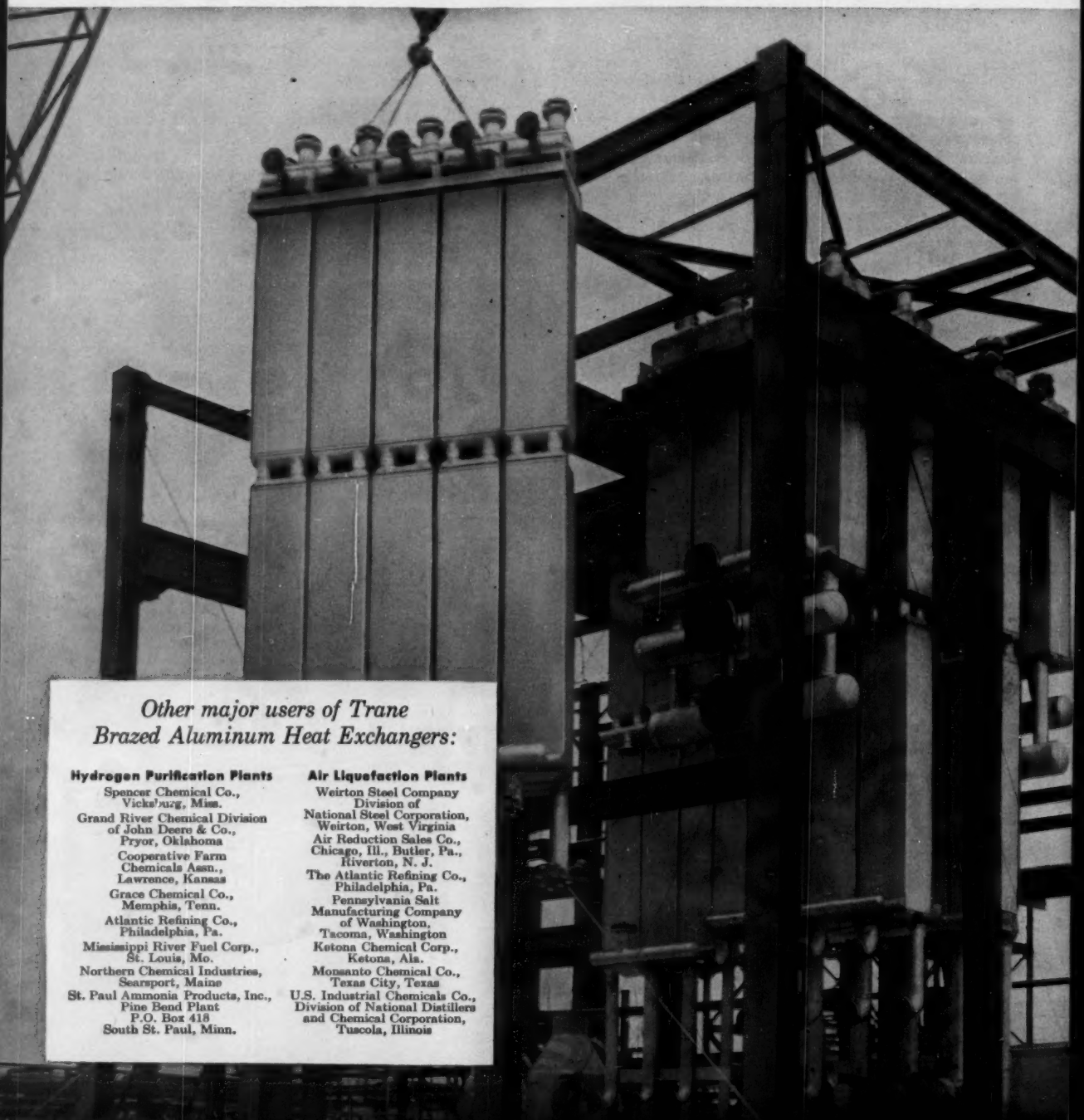
Street_____

City_____ State_____

Rohm and Haas reports:

Close temperature approaches, Trane Brazed Aluminum

Sixty cores of TRANE Brazed Aluminum Heat Exchange surface are used in the production of oxygen at this Rohm and Haas plant. Installation was facilitated by the compact, rugged construction that cuts space and construction costs . . . packs up to 500 sq. ft. of heat transfer surface into one cubic foot. These reversing exchangers were installed by AIR LIQUIDE.



Other major users of Trane Brazed Aluminum Heat Exchangers:

Hydrogen Purification Plants

Spencer Chemical Co., Vicksburg, Miss.

Grand River Chemical Division of John Deere & Co., Pryor, Oklahoma

Cooperative Farm Chemicals Assn., Lawrence, Kansas

Grace Chemical Co., Memphis, Tenn.

Atlantic Refining Co., Philadelphia, Pa.

Mississippi River Fuel Corp., St. Louis, Mo.

Northern Chemical Industries, Searsport, Maine

St. Paul Ammonia Products, Inc., Pine Bend Plant P.O. Box 418 South St. Paul, Minn.

Air Liquefaction Plants

Weirton Steel Company Division of National Steel Corporation, Weirton, West Virginia

Air Reduction Sales Co., Chicago, Ill., Butler, Pa., Riverton, N. J.

The Atlantic Refining Co., Philadelphia, Pa.

Pennsylvania Salt Manufacturing Company of Washington, Tacoma, Washington

Ketona Chemical Corp., Ketona, Ala.

Monsanto Chemical Co., Texas City, Texas

U.S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation, Tuscola, Illinois

high oxygen purity, using Heat Exchangers

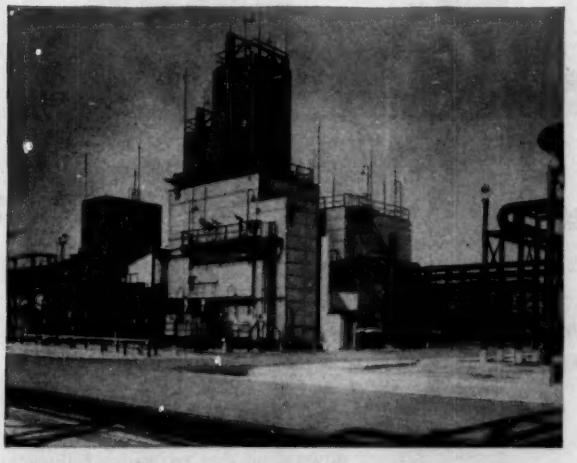
Lightweight, compact exchangers cut installation costs . . . assure trouble-free operation . . . handle up to 6 fluids easily

This Rohm and Haas plant in Pasadena, Texas, designed and constructed by AIR LIQUIDE, produces oxygen of high purity—well above specifications at the design rate —with TRANE Brazed Aluminum Heat Exchangers. After a full year of operation, Rohm and Haas reports temperature approaches as close as 2° F . . . operating temperatures as low as -291° F. And the plant started operation exactly on schedule—initial start up was accomplished within 12 hours.

This lightweight, compact heat exchange surface is being used in more and more installations where superior performance is essential—at over-all low cost. And TRANE Brazed Aluminum Heat Exchangers reduce erection and space costs, too, because a typical TRANE cold box installation requires only *half as much space* as one using conventional heat transfer equipment!

So for reduced refrigeration costs, close temperature approaches and trouble-free operation, design with TRANE Brazed Aluminum Heat Exchangers! Thirty years of specialized heat transfer experience is at your service.

WANT MORE FACTS? Ask your nearby TRANE Sales Office for complete data and application histories. Or write TRANE, La Crosse, Wisconsin.



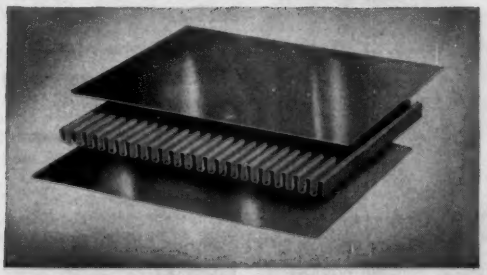
Over-all view of plant. TRANE Brazed Aluminum Heat Exchangers are used in the air plant, CO plant and in the nitrogen scrubbing unit. Plants are designed to operate down to -300° F. with pressures up to 450 psig. Installation in the CO plant features 6-stream operation. The oxygen plant is designed to produce over 300 tons per day.

For any air condition, turn to

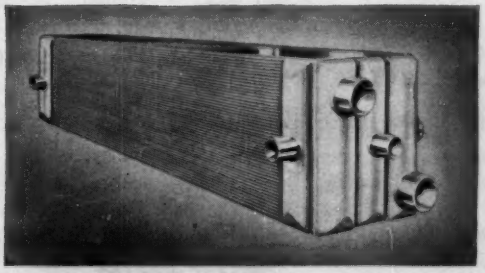
TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

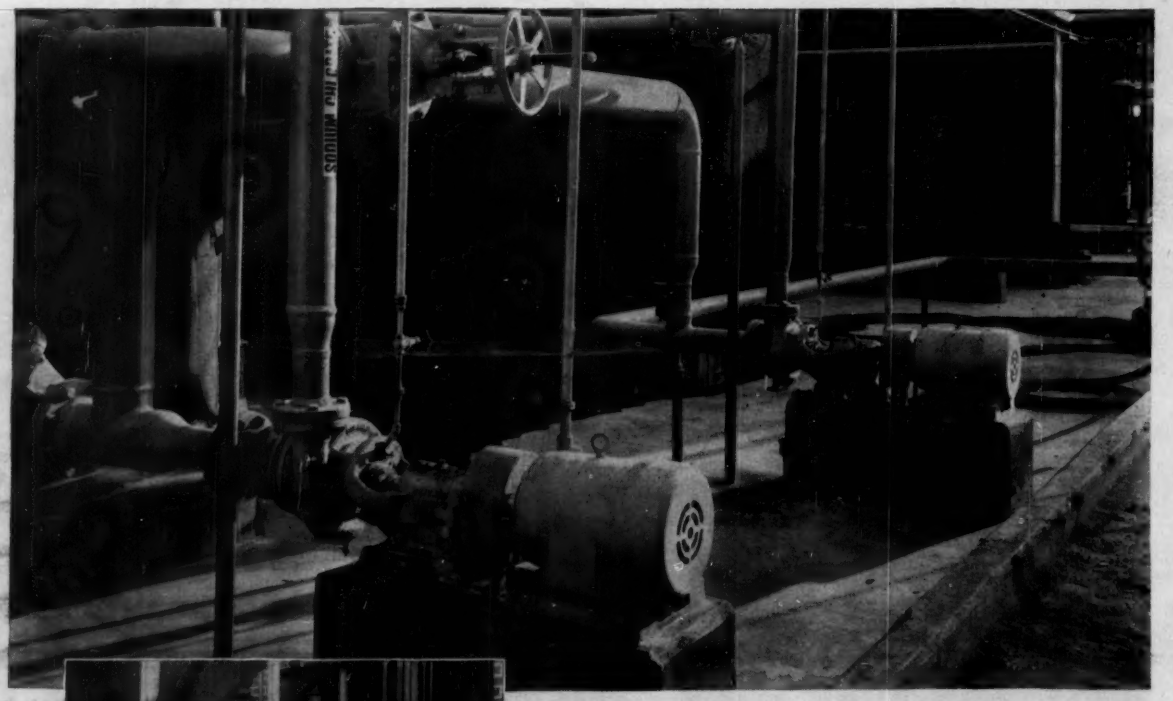
THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO • 100 U.S. AND 19 CANADIAN OFFICES

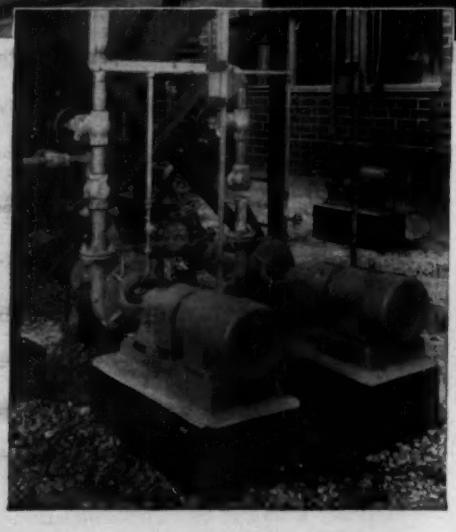


Lightweight, compact! TRANE Brazed Aluminum consists of corrugated aluminum sheets brazed together to form a stack of layers which provide individual passages for the flow of liquids or gases. Provides up to *nine times* the surface per square foot of shell-and-tube exchangers!



Headered for 5-stream operation, this TRANE Brazed Aluminum Heat Exchanger can handle as many as five fluids simultaneously. Units are available for either cross-flow or counter-flow operation. Surface can be fabricated in a wide variety of shapes and sizes to meet all types of requirements.





Above — "Buffalo" Single Suction Full Ball Bearing Pumps, stainless steel construction, handling sodium chlorate.

CORROSION— CONTAMINATION CONTROLLED WITH "BUFFALO" PUMPS

At left — "Buffalo" Single Suction Pumps of stainless steel construction handling hydrogen peroxide bleach.

Using a wide range of materials of construction, "Buffalo" offers a line of pumps capable of handling your toughest liquid moving job. You can order a "Buffalo" pump made of Hastelloy B or C, nickel, bronze, lead, stainless, in fact just about any material that can be cast and machined.

Properly applied, these pumps can cut your liquid moving costs, reduce down-time due to pump failure and improve quality control where contamination may be a factor.

For your tough liquid moving jobs, phone or write your "Buffalo" Engineering Representative or write direct. Tell us the liquid you want to pump and we will be pleased to suggest the best material of construction for the job.

"Buffalo" PUMPS

BUFFALO PUMPS DIVISION OF BUFFALO FORGE CO.

501 Broadway Buffalo, N.Y.

Canada Pumps Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

HELPS EYE PROTECTION PAY OFF!

- SMALL
- COMPACT
- HANDY
- NONCORROSIVE

AO 750
LENS CLEANING
CABINET

American Optical
COMPANY
SAFETY PRODUCTS DIVISION
SOUTHBRIDGE, MASSACHUSETTS
Safety Service Centers in Principal Cities

A Complete Cleaning Establishment in a One-Foot* Wooden Chest!

*(12" long, 9" high, 6" deep)

Always insist on Trademarked Safety Products

QUICK FACTS

Complete unit consists of:

(1) No. 750B 6 oz. bottle and sprayer (750S) (standard)

(2) No. 750F Lens Cleaning Fluid (upon request)

(3) No. 750T 2 Boxes of Cleansing Tissue, each containing 120 sheets (standard)

(4) No. 111 One 1-oz. jar of 111 anti-fog paste (standard)

NOTE: Order combined 350AF Super-Clear cleaner and anti-fog fluid separately.

It's superior.

Provides all necessary cleansing and anti-fog materials for glass and plastic safety glasses, goggles and face shields and personal glasses.

WOODEN CONSTRUCTION — it won't corrode. No metal parts, even plunger is plastic. No waste — paper is dispensed one sheet at a time in pop-up fashion and is highest grade wet strength. Disposal compartments prevent litterbugging — keep area neat. Unit attaches to wall at handy plant locations. Instructions on front.

750F Fluid originally recommended for use with this cabinet and still available is primarily a cleaning fluid. For combined cleaning and anti-fogging in one operation, specify our 350AF SUPER CLEAR. Keeps surfaces fog-free longer than any other solution — tests prove it! Just spray on — wipe off.

Be Safe for Sure... with AO SURE-GUARD Products

FROM THE
BOILER CAPITAL
OF THE WORLD

100

THE TITUSVILLE-ATLAS

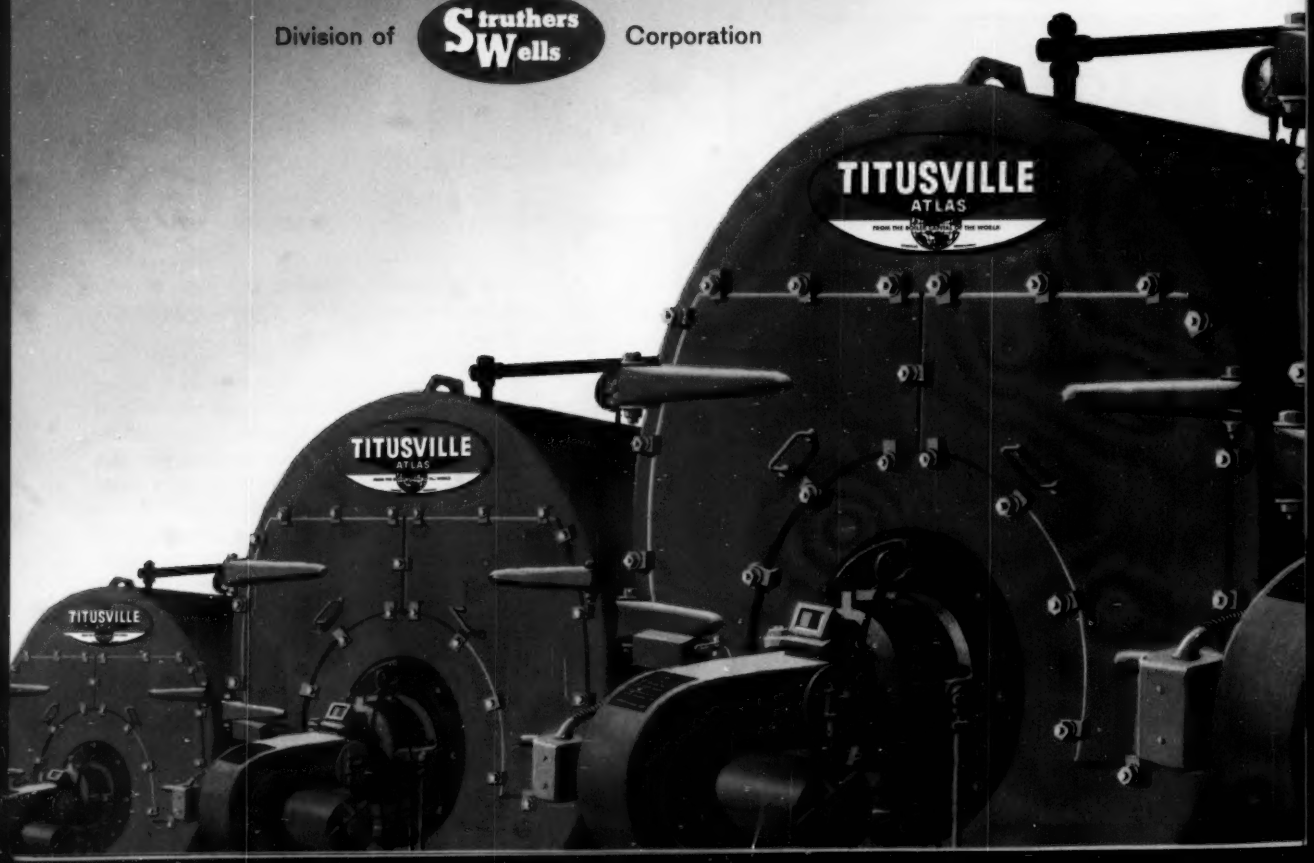
What kind of a heading is 100 x 1,000 for an ad about boilers? Well, it's not a magic formula . . . it just represents a simple fact—Titusville has produced and sold more than 100,000 boilers. That's why Titusville is known as *the boiler capital of the world!*

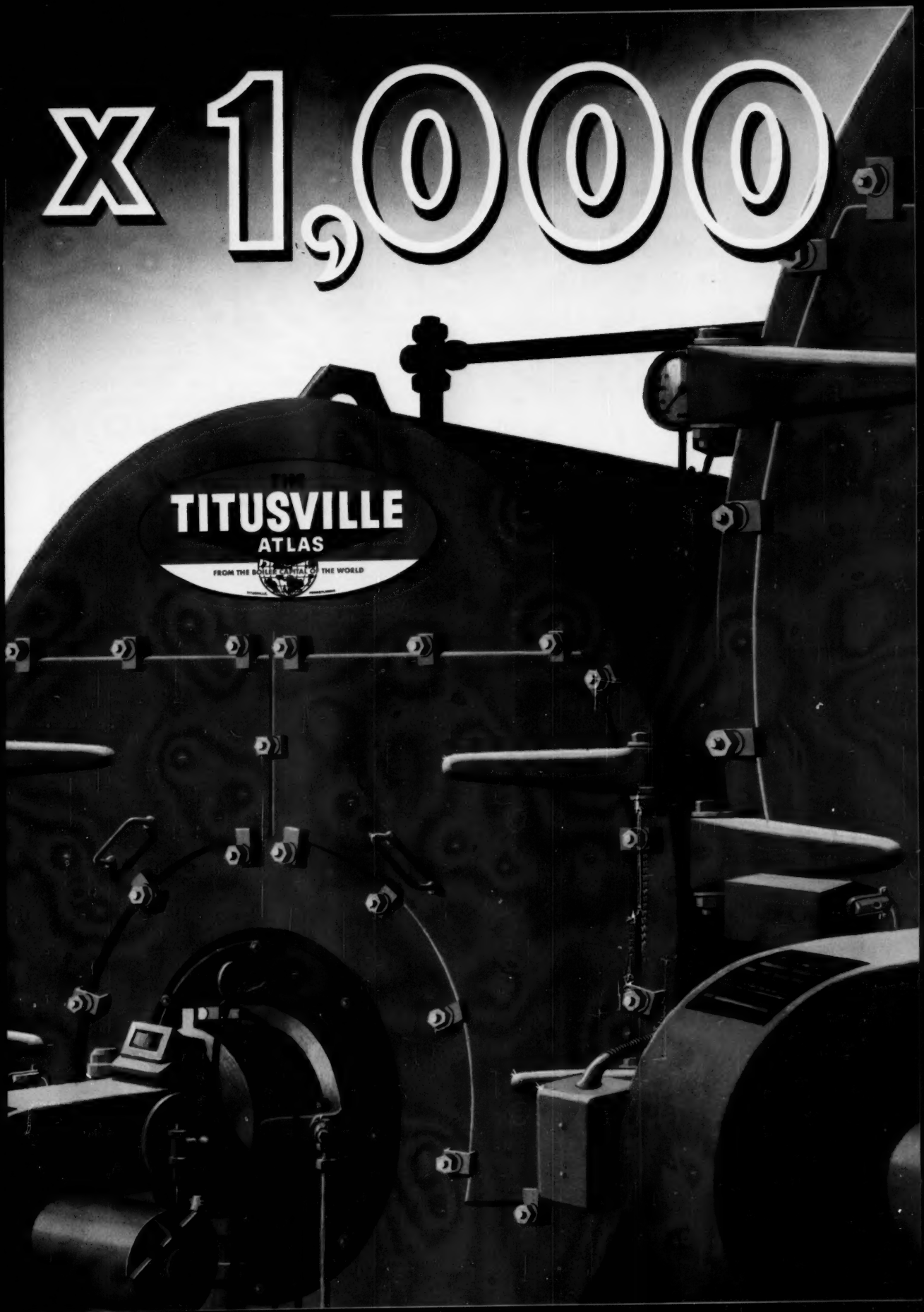
The complete TITUSVILLE-ATLAS unit, known for its BONUS POWER, is the result of the engineering know-how and experience that has gone into the production of those 100,000 boilers. TITUSVILLE-ATLAS—the only unit with a patented wet-back, assuring you of longer life . . . higher maintained efficiency . . . fewer repairs and more horsepower per total energy input.

VNA 6963

THE TITUSVILLE IRON WORKS COMPANY
TITUSVILLE, PENNSYLVANIA

Division of Struthers Wells Corporation



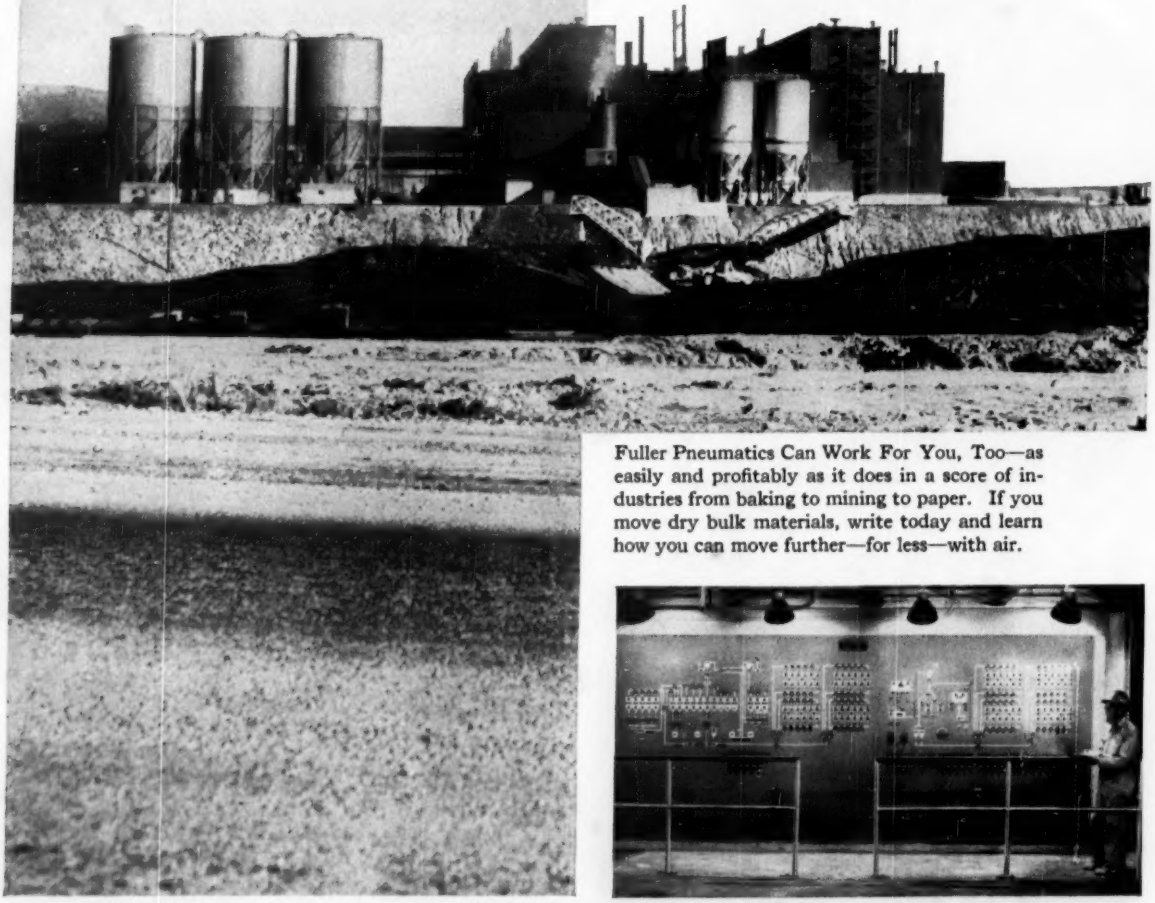

x 1,000
THE
TITUSVILLE
ATLAS
FROM THE BOULE CAPITAL OF THE WORLD

How Pneumatic Conveying Helps Make New Mining Process Economically Practical

Taconite processing is typical of the many varied, cost-saving applications for Fuller Pneumatic Conveying.

They're turning low assay iron ore into rich pellets on the Mesabi these days. Moving additives for pelletizing, Fuller plays a special role in this feat of engineering and production economy.

Fuller Pneumatic Conveying Systems are carrying fine anthracite screenings, soda ash, and bentonite from siding to storage to processing—with speed, safety, sanitation, and efficiency. With few moving parts to wear out and powered by inexpensive low-pressure air, Fuller Pneumatic Conveying Systems speed dry bulk materials *anywhere that a pipeline can be run:* under ground, up through floors, around corners . . . for far greater distances and at substantially lower cost than possible with mechanical conveyors.



Four Fuller Pneumatic Systems can speed more than 307 long *tons* of additives through this huge Taconite Pelletizing Plant in a single day.

Fuller Pneumatics Can Work For You, Too—as easily and profitably as it does in a score of industries from baking to mining to paper. If you move dry bulk materials, write today and learn how you can move further—for less—with air.

Centralized control is provided by giant panel designed and manufactured by Fuller.

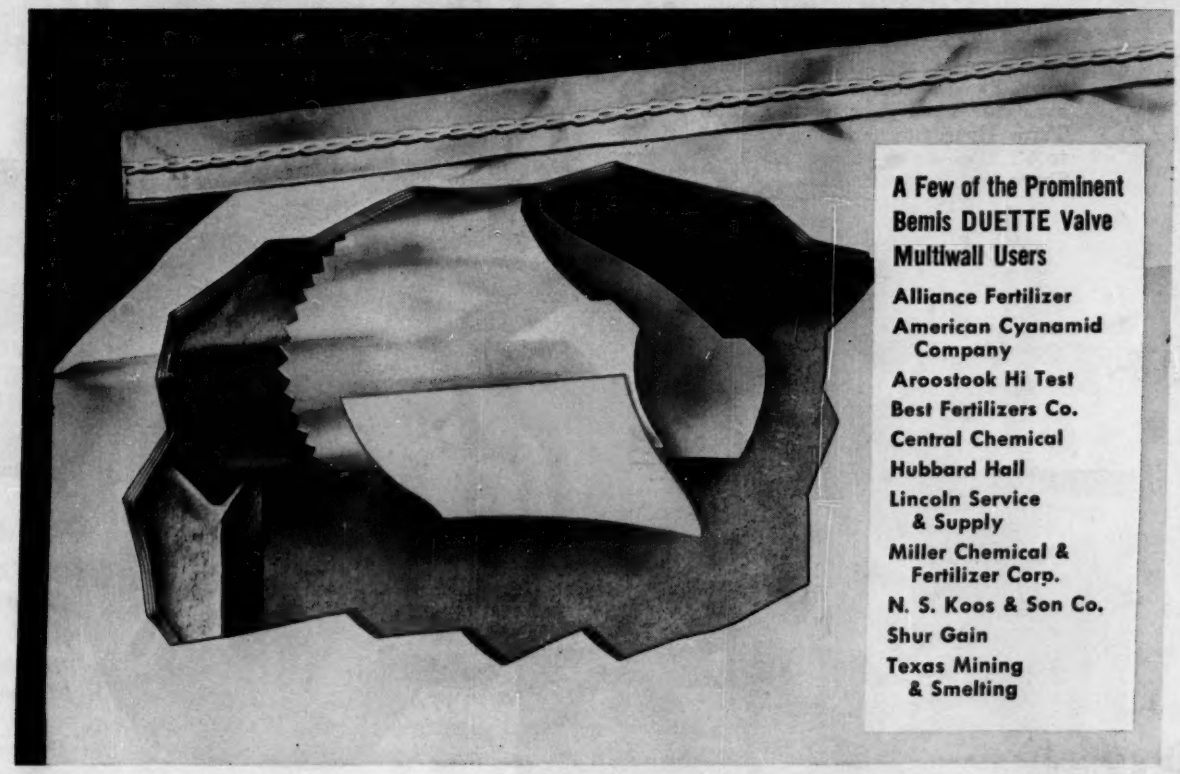
For complete details see Chemical Engineering Catalog

FULLER COMPANY
134 Bridge St., Catasauqua, Pa.
Subsidiary of General American Transportation Corporation
Offices in Principal Cities Throughout the World

Fuller
. . . . pioneers in harnessing AIR

2097
G229

Bemis *Duette*® Sewn Multiwall Sleeve Valves Have Been Experience-Proved

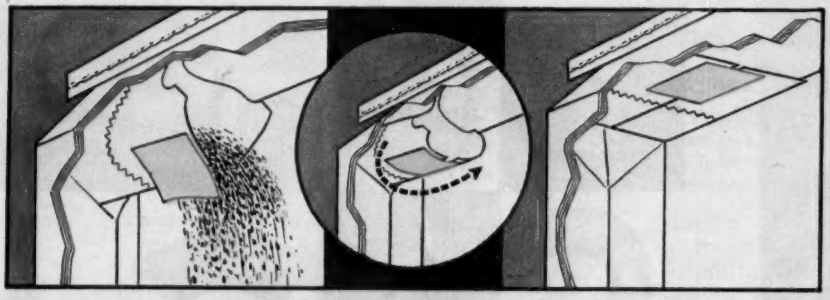


A Few of the Prominent Bemis DUETTE Valve Multiwall Users

- Alliance Fertilizer
- American Cyanamid Company
- Aroostook Hi Test
- Best Fertilizers Co.
- Central Chemical
- Hubbard Hall
- Lincoln Service & Supply
- Miller Chemical & Fertilizer Corp.
- N. S. Koos & Son Co.
- Shur Gain
- Texas Mining & Smelting

It's been more than three years since Bemis perfected the DUETTE, the multiwall bag valve-on-a-valve that gives double sift protection for granular, pelletized or pulverized products.

In that time, DUETTE Multiwalls have been used by many of the leading chemical and fertilizer manufacturers, with consistently gratifying results. The diagrammatic pictures show why . . .



WON'T CLOG . . . The Magic Yellow check flap falls freely aside from the valve slit. The sleeve won't choke or clog the packing spout.

POSITIVE CLOSING ACTION . . . This diagrammatic picture shows the action as the Magic Yellow flap starts to close over the valve slit.

CAN'T SIFT . . . When the bag is filled, the flap, acting as a check valve, completely overlaps and covers the valve slit, to stop sifting.

General Offices
408-R Pine Street
St. Louis 2
Sales Offices in Principal Cities

NEW...FROM TUBE

FROM YOUR TUBE TURNS' DISTRIBUTOR

The complete line of PIPE-MATE Fittings, Flanges and Accessories are available from your nearby Tube Turns' Distributor. For pipe sizes ½" to 4"... Schedules 5S and 10S... in Types 304L, 316 and 316L.

TURNS...

PIPE-MATE light-wall stainless steel fittings and flanges

Tube Turns introduces another important key to lower piping costs... a new line of light-wall stainless steel fittings and flanges for process piping. Here's how this PIPE-MATE* line reduces costs...

Cuts material costs. Compared to standard weight Schedule 40S pipe, *light-wall* piping in Schedule 5S or 10S cuts material costs as much as 30% to 50%. It weighs ½ to ⅓ as much, is easier to handle, easier to install and provides greater flow area.

Simplifies installation. Extra long tangents of PIPE-MATE fittings provide full straight-line clearance for fitting-to-fitting connections and permit fabrication of completely flanged elbows, returns, tees, etc. Aligning connector speeds making of socket type joints. Fittings may be butt-welded, fillet-welded, brazed or soldered, or joined by rolled-in flange connections.

Here is another plus value you get when you specify products of Tube Turns and buy them from your Tube Turns' Distributor.

FREE BULLETIN on PIPE-MATE Fittings and Flanges describes complete line, shows installation procedures, and gives properties and dimensional tolerances. Mail coupon for copy.

*"PIPE-MATE" and "tt" are trademarks of Tube Turns.

Another tt plus value from...

TUBE TURNS

DIVISION OF CHEMETRON CORPORATION

Louisville 1, Kentucky

CHEMETRON

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IN CANADA: TUBE TURNS OF CANADA LIMITED, Ridgetown, Ontario
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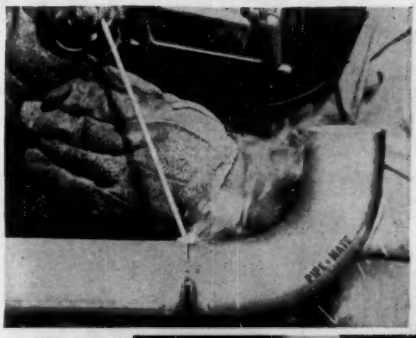
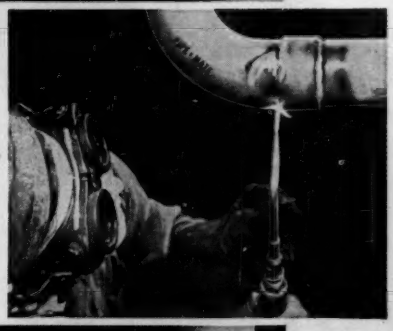
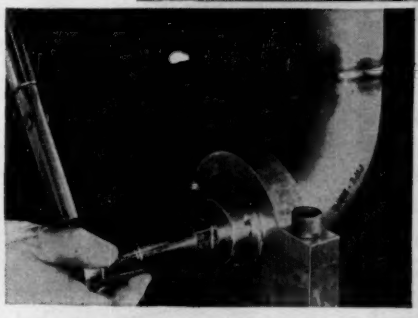


FOR BUTT-WELDING



FOR FILLET-WELDING, BRAZING OR SOLDERING

FOR ROLLED-IN FLANGED JOINTS



TUBE TURNS
Department CE-4, 224 East Broadway
Louisville 1, Kentucky

Please send bulletin TT944AR.

Company Name _____

Company Address _____

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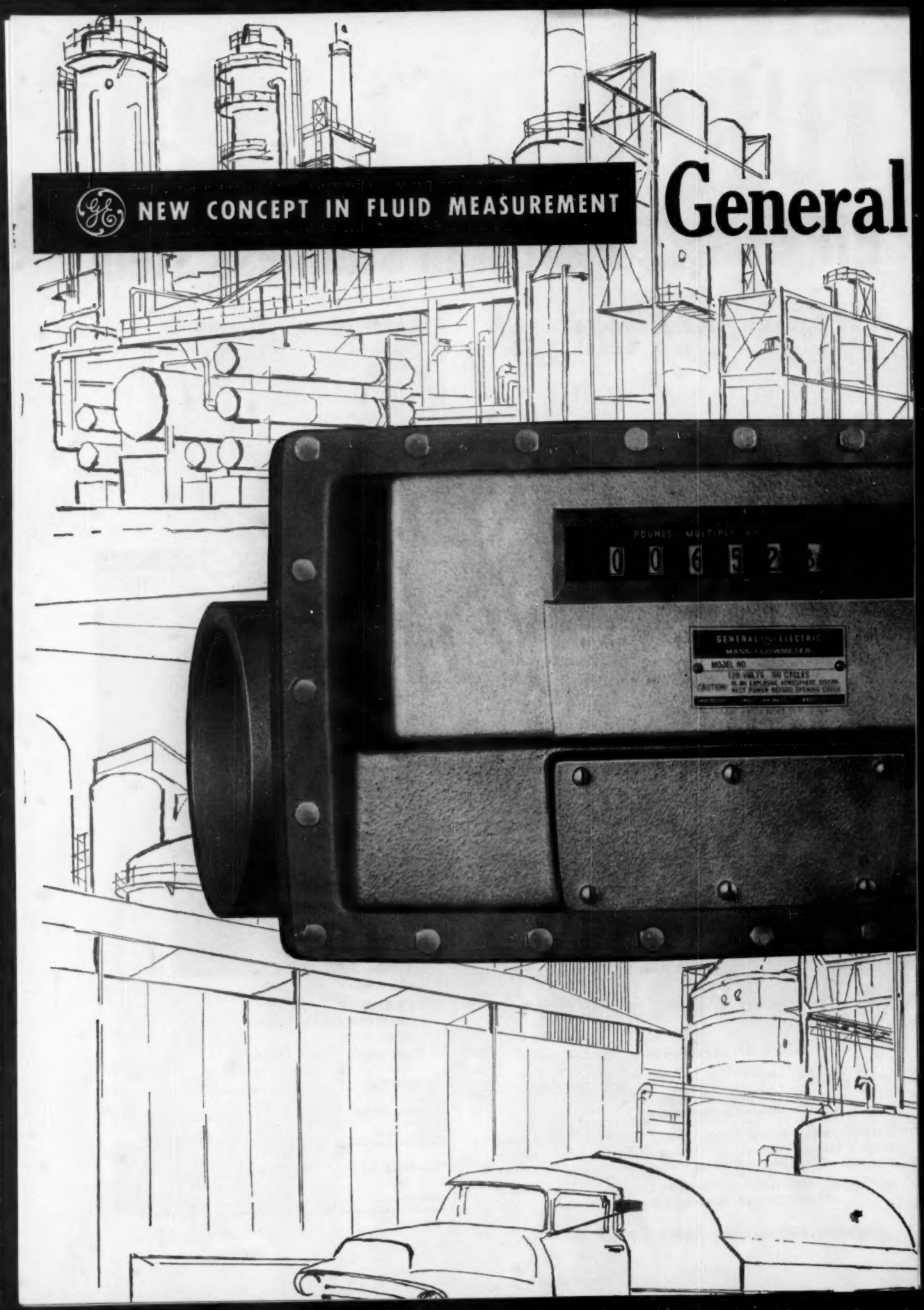
Your Name _____

Position _____


NEW CONCEPT IN FLUID MEASUREMENT
General
POUNDS MULTIPLY BY
0 0 6 5 2 3
GENERAL ELECTRIC
MASS FLOWMETER
MODEL NO.
120 VOLTS 60 CYCLES
CAUTION:

Electric Gyro-Integrating True Mass Flowmeter

ACCURATELY MEASURES FLOW OF LIQUIDS, GASES AND LIQUEFIED GASES . . . DIRECTLY IN POUNDS

This new General Electric meter provides continuous local or remote totalization and registration of gas and liquid flow by weight within ±1 percent accuracy over wide variations in flow rate, density, pressure, temperature and viscosity.

PROCESS FLOW MEASUREMENT—Ideal for applications in the petroleum, chemical, and petro-chemical industries, the new mass flowmeter completely eliminates time-consuming orifice calculations and possible costly errors in correcting volumetric readings for fluid variables. It does away with the need for recalibration when process and flow conditions change, too. And it puts an end to supercompressibility problems.

What's more, the new flowmeter lets you make complete and accurate material balances easily because it operates on a mass measurement principle and gives you your answer *in pounds*. No more measuring liquids in gallons or barrels, gases in cubic feet, then making tedious conversions in order to equate the two. Measurement of both by weight allows direct comparison.

LIQUEFIED GAS MEASUREMENT—You can measure the weight of truck and tank car loading of your liquefied gas products easier and faster with General Electric's new mass flowmeter than with present volumetric-type meters or expensive and cumbersome scale installations. The meter registers the total loaded weight directly in pounds. Then, operating from a battery-inverter power supply, the flowmeter can be used right on your truck when unloading, for easy and accurate deliveries. And no precautions are necessary to protect the meter from high velocity caused by "flashing."

An outgrowth of General Electric research into mass flow measurement, this new meter has already been proved on such fluids as natural gas, ethylene, Freon, liquid carbon dioxide, naphtha and jet fuel.

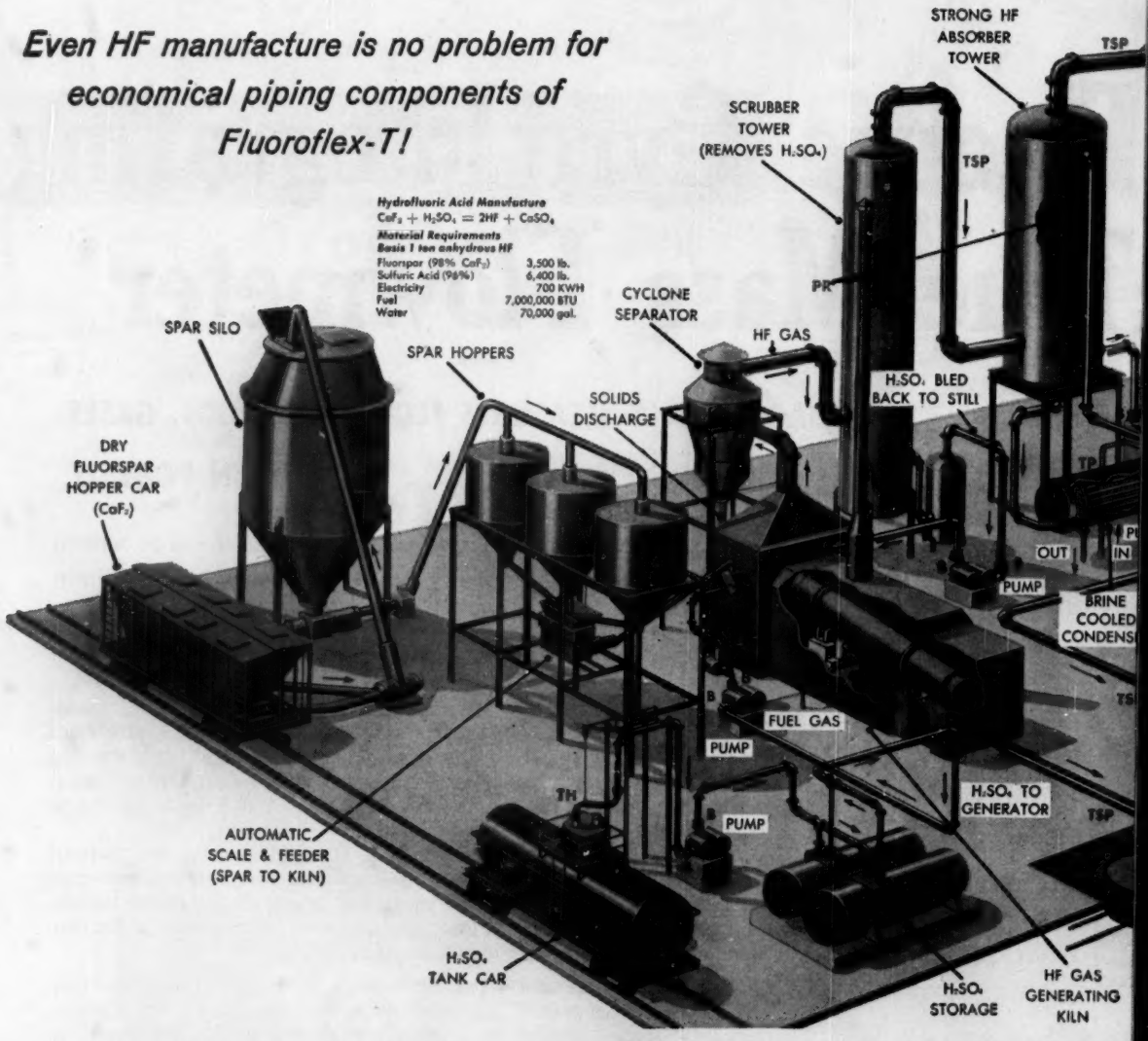
For complete sales and service information, contact your nearby General Electric Apparatus Sales Office, or write for bulletin GEA-6925A, Section 599-02, General Electric Company, Schenectady 5, N. Y. On applications in the natural gas industry, contact Black, Sivalls and Bryson, Inc., Kansas City, Missouri.

FOR QUALITY... PRODUCTIVITY ...PROFIT — INSTRUMENTATION FOR AUTOMATION

INSTRUMENT DEPARTMENT

GENERAL ELECTRIC

Even HF manufacture is no problem for economical piping components of Fluoroflex-T!



NOW AT LAST, for all your corrosive of long-life, corrosion-

Now it is possible for you to pipe your entire corrosive process from start to finish in corrosion-impervious Fluoroflex®-T, to save you money in faster installation, and decreased maintenance, process downtime, replacements, and production headaches!

Fluoroflex-T, the proprietary Teflon® product manufactured and fabricated solely by Resistoflex, combines two important elements:

1. The widely-known corrosion-imperviousness of Teflon; complete resistance to *any* chemical (except high-temperature fluorine and the molten alkali metals) up to 500°F.!

2. Optimum flexibility, density, strength, and flex-life; nonporosity and structural uniformity; all imparted by Resistoflex's superior fabrication techniques.

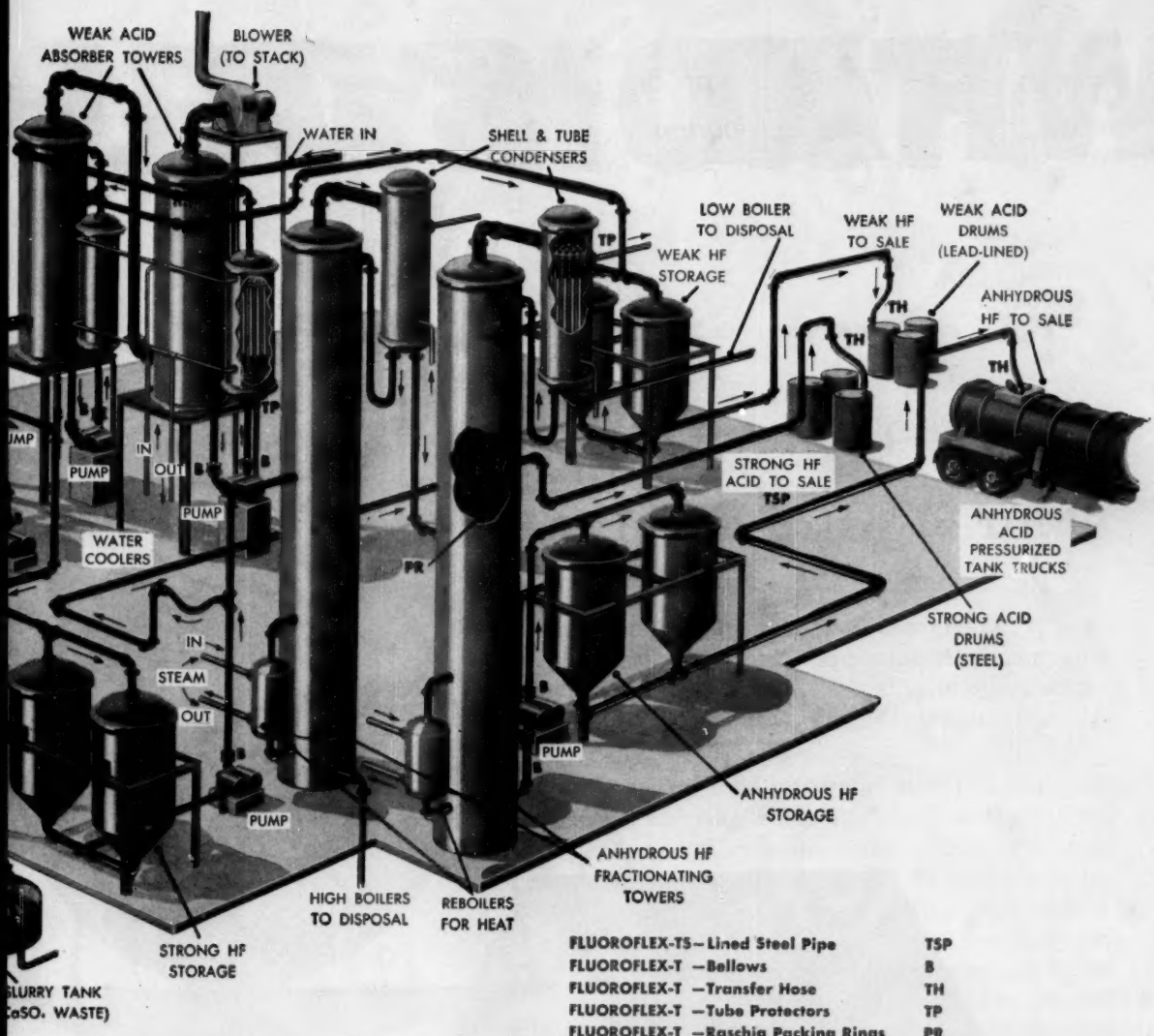
As to the kind of economies possible, one plant equipped with Fluoroflex-T reported savings of $60,000 per month in costs of maintenance, downtime, and product loss!

This in addition to installation economies. The Fluoroflex-T family of corrosion-resistant piping components (see panel at side) have all been designed for complete couplability and hookup ease, in a complete range of sizes to fit any flow, process, or process path.

If *you* have problems of handling corrosive fluids—in cost, equipment maintenance and replacement, process downtime—why not talk them over with Resistoflex? As they have for others, their fully experienced staff of engineers and equipment specialists may be able to save *you* money, time, and headaches! Write for Bulletin today!

Check These Versatile Fluoroflex-T Piping Components for Economy, Installation Ease, Long Process Life!

Fluoroflex-T Lined Steel Pipe: Prefabricated to section lengths, conforming to your blueprint specs, with flanges on and ready to assemble. Minimizes assembly time; shortens checkout time; suitable for all fluids; complete series of fittings and connections available.



FLUOROFLEX-TS—Lined Steel Pipe	TSP
FLUOROFLEX-T —Bellows	B
FLUOROFLEX-T —Transfer Hose	TH
FLUOROFLEX-T —Tube Protectors	TP
FLUOROFLEX-T —Raschig Packing Rings	PR

piping problems, the overall economy proof FLUOROFLEX-T (TEFLON)!

Chemical Transfer Hose: Completely resistant to corrosion; long flex life; available in rubber or stainless steel braid coverings. The answer to all your flex hose problems!

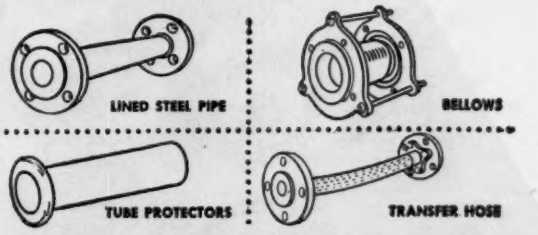
Molded Bellows-Flex Joints: Up to one million flexings without detectable deterioration! Adjust to longitudinal and temperature movements, damp out equipment vibrations. Molded rather than machined, their built-in flex-life can add years to the life of your piping and equipment!

Dip Pipes, Spargers, Thermowells: For non-corrosive nozzle openings, steam nozzles, instrument wells in process equipment.

Condenser Tube Protectors: Eliminate erosion and corrosion of high-velocity acid in entry side of condenser tubes.

And also:

Fluoroflex-T Tower Packing Rings: Light in weight, durable, corrosion and erosion resistant, these economical Raschig rings have only one-fourth the weight of monel rings! Next time you need tower packing, check on these to simplify your tower design, costs, maintenance problems!



RESISTOFLEX

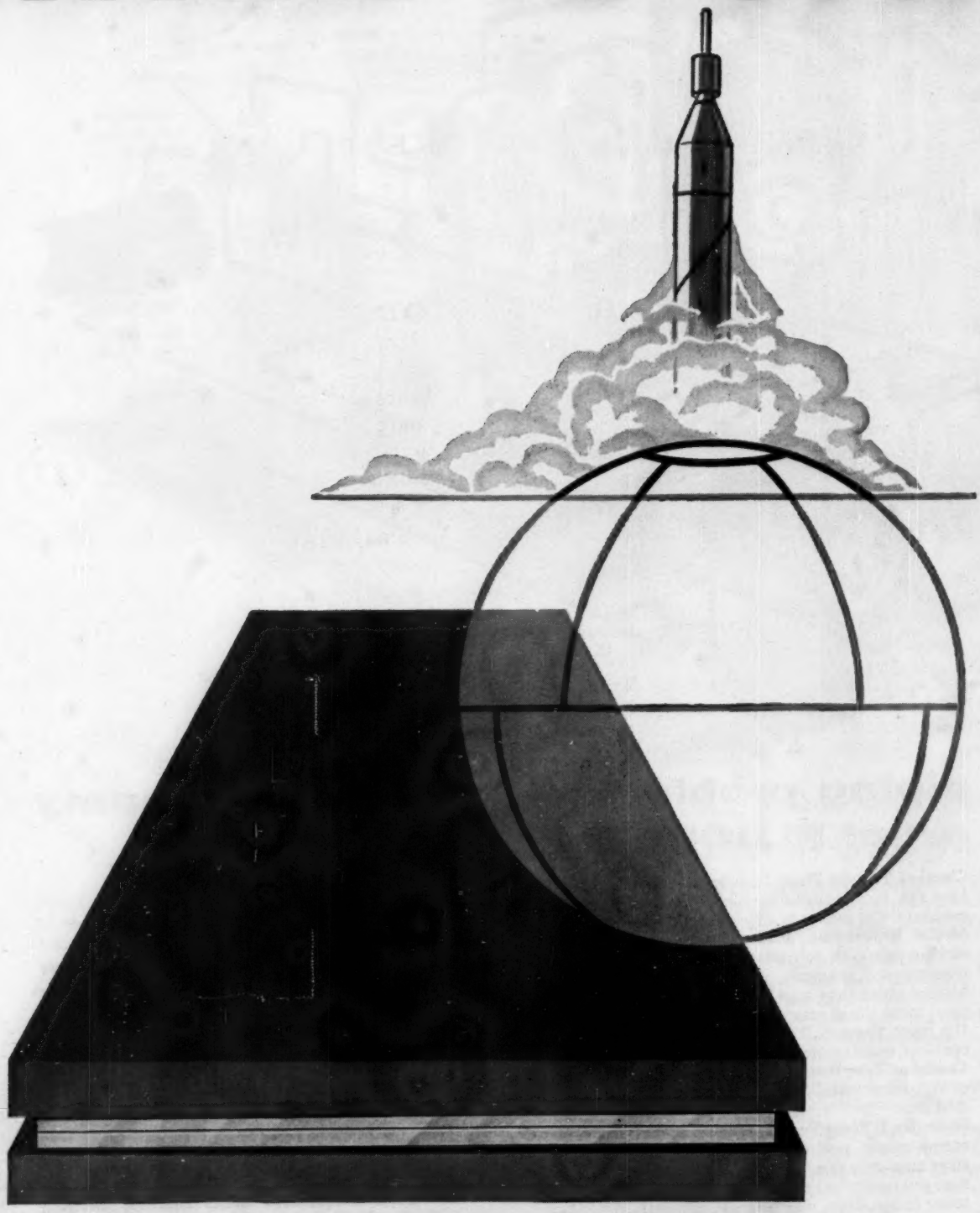
CORPORATION

Complete systems for corrosive service

Plants in Roseland, N. J. • Anaheim, Calif. • Dallas, Tex. • *Sales Offices* in major cities

®Fluoroflex is a Resistoflex trademark, reg. U. S. Pat. Off.
®Teflon is DuPont's trademark for TFE fluorocarbon resins.

WHAT IS CF&I-

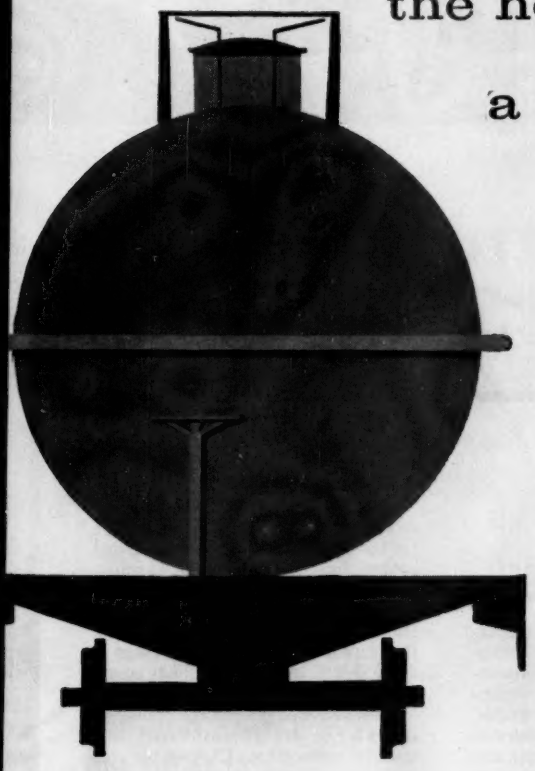


CLAYMONT?

CF&I-Claymont is a steel sandwich...

the head of a tank car...

a vault for missile fuels



Claymont bears the CF&I trademark; it is an important part of this major steel company. Claymont is ability—the ability to manufacture steel plate and plate products to the most demanding customer specifications.

Claymont is an integrated steel mill that rolls carbon and alloy steels into plates of many sizes, shapes and thicknesses. Some of these are made into steel sandwiches — stainless steel plates inseparably bonded to carbon or alloy steel backing plates. These stainless-clad plates are used in many applications requiring corrosion and abrasion resistance. Other plates are spun or pressed into heads, some of which may become integral parts of railroad tank cars. Claymont also makes plates into many special shapes and parts; one example–a container for liquid oxygen rocket fuel.

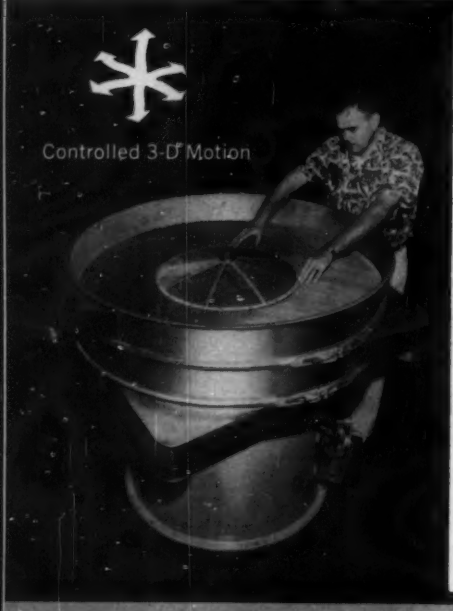
Claymont invites you to tour our plant whenever you're in the neighborhood. You'll find our modern Fabricated Plate Shop of special interest. In the meantime, you can receive complete information about CF&I-Claymont's facilities and services from any CF&I office.

CLAYMONT STEEL PRODUCTS
THE COLORADO FUEL AND IRON CORPORATION
DENVER • OAKLAND • NEW YORK
sales offices in all key cities

CF&I STEEL

De Laval tackles process problems

...economically!



Getting all shook up on one horsepower!

It speaks well for the design and operating efficiency of the De Laval Syncro-Matic that its high-capacity 3-dimensional screening action is all accomplished with a *one* horsepower motor. The energy you pay for is concentrated on your product rather than being dissipated by attacking your floor beams. Tune the controls for gentle sifting or for turbulent, high-throughput classification and you can count on quiet, practically vibration-free performance.

Unlike ordinary screens based on eccentric weights, the action of the De Laval Syncro-Matic is positive and controllable—and unaffected by variations in screen loadings. Use of the three calibrated motion controls lets you achieve optimum screening action. Capacity improvements in the range of 50 to 300% over conventional equipment have been reported.

Mounted screens (single, double or triple) are drum-tight—easily and quickly replaceable. Choose between plain or stainless steel construction. Your product – wet or dry, fine or coarse, crystal-hard or delicately soft – will be more efficiently classified, more rapidly processed—or both.

For Further Information Write To Dept. C-1

DE LAVAL

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York
5724 N. Pulaski, Chicago 46, Illinois

DE LAVAL PACIFIC COMPANY, Dept.
201 E. Millbrae Avenue, Millbrae, Calif.

CENTRIFUGES
PLATE HEAT EXCHANGERS
VIBRATING SCREENS
COMPLETE PROCESSES

After the "Clarifier" and the "Nozzle-Bowl" ...what?...This!

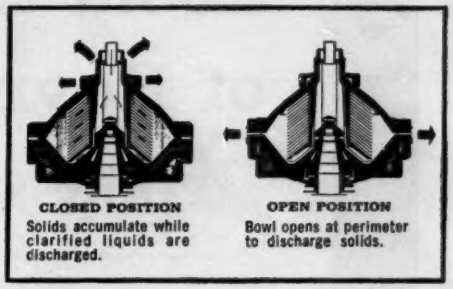
Problem A: An immiscible liquid mixture is to be centrifugally separated. An unwanted heavy sediment is also present.

Problem B: A solids suspension is to be continuously separated from a liquid (or liquid mixture), concentrated and reclaimed.

Complication: The solids are so plentiful they fill a "clarifier" bowl too quickly. Or the feed rate is too low to warrant a continuous-discharge nozzle-bowl centrifuge. Or the solids are too large for nozzle discharge. Or you want to wash the solids before discharge. Or...

Solution: Such complications dissolve into routine operating procedure when one of De Laval's new PX self-opening separators is used. While the liquid mixture is being efficiently separated and discharged, the solids accumulate in the ample bowl wall space. At a predetermined solids build-up, the bowl is opened at the perimeter, and pffft!... out go the solids to a discharge cover. The De Laval "PX" never misses an RPM!

Applications possibilities are legion in the processing of foods, fats, oils and chemicals...especially for De Laval's unusually compact, more economically operated models. Be the first in your group with the facts! Write for the "De Laval PX Self-Opening Separator" leaflet!



CLOSED POSITION
Solids accumulate while clarified liquids are discharged.

OPEN POSITION
Bowl opens at perimeter to discharge solids.

AN INCH, AN OUNCE, AN ERG...

Small differences add up to significant considerations when choosing equipment. The economy of power in our Synchro-Matic screen separators has its **real** meaning in operating performance. Inches add to many cubic feet or yards saved with our remarkably compact Plate Heat Exchangers. Special disc design in our Centrifuges makes a larger capacity possible for a given frame size. Such not-so-small differences add up to many years of operating payoff!

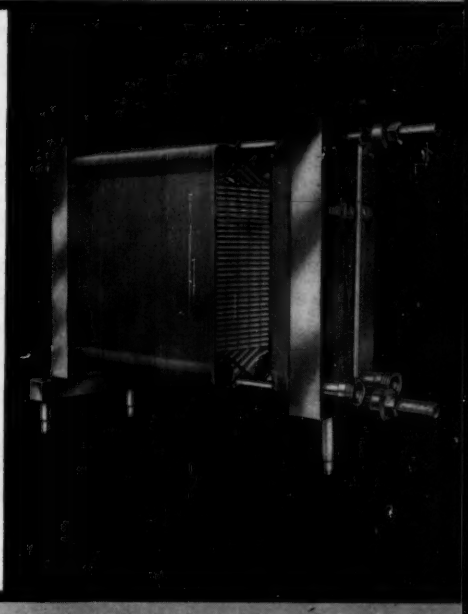
Fred Wheelwright, Industrial Manager

Laminar flow licked at Reynolds no. 180!

Memory being what it is, process engineers often forget that a 2100 Reynolds number is the borderline for turbulent flow *only* for flow in smooth tubes. In our De Laval Plate Heat Exchangers, the plate corrugations completely frustrate laminar flow and many operate with high transfer efficiency at Reynolds numbers in the range of 180.

Then there's the fact that heat transfer coefficients are normally 600-750 and often over 900 Btu/hr-ft²-°F. And also that for equal heat transfer coefficients, De Laval Plate Heat Exchangers require a lower pressure drop than shell-and-tubes.

With operating efficiencies that shell-and-tubes can't match – with multi-compartmentation easily arranged – with remarkable compactness – and with easily added capacity at any time – De Laval's stainless steel Plate Heat Exchangers are gaining steadily on the cheaper (but more costly to install and operate) shell-and-tubes. Join the "modern design" group. Send for booklet!



What you should know about the economics of Reynolds Aluminum Process Pipe

Reynolds Aluminum Process Pipe—strong, lightweight, and corrosion-resistant—costs no more than cold rolled black steel or galvanized steel pipe, when you consider the total installed cost. For example, the table below shows that the base price of Reynolds Aluminum Heavy-End Pipe is almost as low as galvanized steel. Shipping and installation costs for aluminum pipe are invariably lower than heavier pipe—usually from 15 to 30% less.

PIPE COSTS COMPARED

4" Schedule 40 Pipe (Plain End) 100 feet	*Carload Price	Freight to West Texas from Eastern U.S.	Total
Black Steel	98.37	15.86	114.23
Galvanized Steel	117.72	15.86	133.58
Aluminum Heavy End* Alloy 6063-T6	143.75	—(1)	143.75
Aluminum Alloy 6063-T6	179.15	—(1)	179.15
Stainless Steel 304 Schd. 10	621.77	15.86	637.63
Stainless Steel 304 Schd. 40	1065.80	15.86	1081.66

*Quoted as of March 25,1960 (1) Aluminum prices include delivery charges

The table also shows that aluminum pipe is the lowest-cost corrosion-resistant pipe you can buy. Reynolds Aluminum Heavy End Pipe costs about 1/4 as much as stainless 304, Schedule 10, and about 1/7 as much as stainless 304, Schedule 40.

RESISTS CORROSION, WON'T RUST OR CONTAMINATE

The list of corrosive chemicals and process products that aluminum can handle is a long one, and it includes fluids that rapidly corrode other metals. Corrosion-resisting aluminum is ideal for process operations in the chemical, food, beverage, soap, drug, petroleum and petrochemical industries.

LIGHTWEIGHT, BUT STRONG

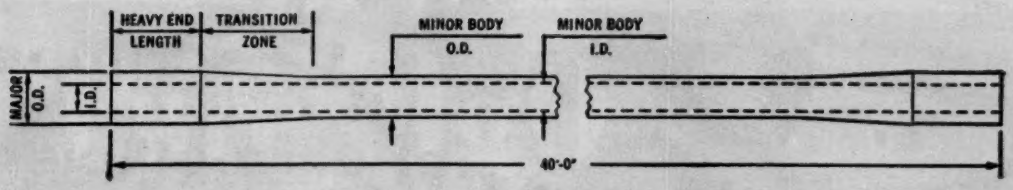
Only one-third as heavy as steel, Reynolds Aluminum Pipe costs less to handle, to ship, and to install. It requires less support, and is easier to move for temporary installations. Yet, aluminum is strong—strong enough to take rough handling and normal operating pressures. In fact, at lower temperatures (down to −320°F) where some metals grow brittle and weak, aluminum is actually *stronger*, with improved tensile and yield strengths, and ductility.

EASY TO WORK, WELD, JOIN

Aluminum is one of the easiest metals to form, bend, cut and join. It welds speedily and securely by any common welding method. You can choose from a large variety of forged and cast aluminum fittings, flanges and couplings for grooved, threaded, and welded joints. This means more design flexibility, lower installation costs. Other unique characteristics of aluminum pipe are also important: It is non-sparking, safer to use with volatiles. And, the smooth inside surface of Reynolds Aluminum Pipe means less danger of scale formation—you get improved product flow that can hold pumping costs down.

AVAILABILITY

Reynolds Aluminum Process Pipe is available in schedules 5, 10, 40 and 80. Diameters range from 1/8" to 12", and thicknesses range from .065" to .200". In addition, Reynolds Aluminum Pipe is available in both Duplex and Heavy-End types.



Reynolds Aluminum Heavy-End Pipe

REYNOLDS DUPLEX PIPE

Reynolds Duplex Pipe is actually a two-pipe steam trace system in one. A dividing wall inside the tube provides two separate channels—one for steam or condensate, the other for the viscuous product. Duplex eliminates an outside steam line and the cost of fastening the two pipes together, and it minimizes insulation needs.

HEAVY-END PIPE

Reynolds Aluminum Heavy-End Pipe can save up to 28% in piping costs. Heavy-End Pipe, with a constant inside diameter, is thicker at the ends to compensate for the loss in mechanical properties due to welding or grooving. Excess metal is eliminated in the pipe body and extra strength is provided where it's needed most—at the joint. It enables you to design a uniformly strong system without paying for extra metal, without overdesigning. Heavy-End Pipe is available in schedule 40 and 80 equivalents, and takes standard fittings.

REYNOLDS—FOR ALUMINUM PIPE, ALUMINUM KNOW-HOW

When designing any process system, plan for economy and long, efficient service; plan with Reynolds Aluminum Process Pipe. For details, contact your local Reynolds office, or write for complete file on the uses of aluminum in the chemical process industry. Use coupon below.

Reynolds Aluminum Duplex Pipe

REYNOLDS ALUMINUM SPECIALTY PIPE DISTRIBUTORS

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Gulf Coast Marine Supply Company
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and
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Industrial Piping Supply Co.
1501 Dowd Rd. • P.O. Box 10218 • Charlotte, N.C.

McJunkin Corporation
P.O. Box 513 • Charleston 22, West Virginia

Piping Products Company, Inc.
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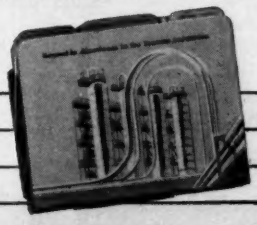
Watch Reynolds TV shows: "ADVENTURES IN PARADISE," "BOURBON STREET BEAT" and "ALL STAR GOLF"—ABC-TV.

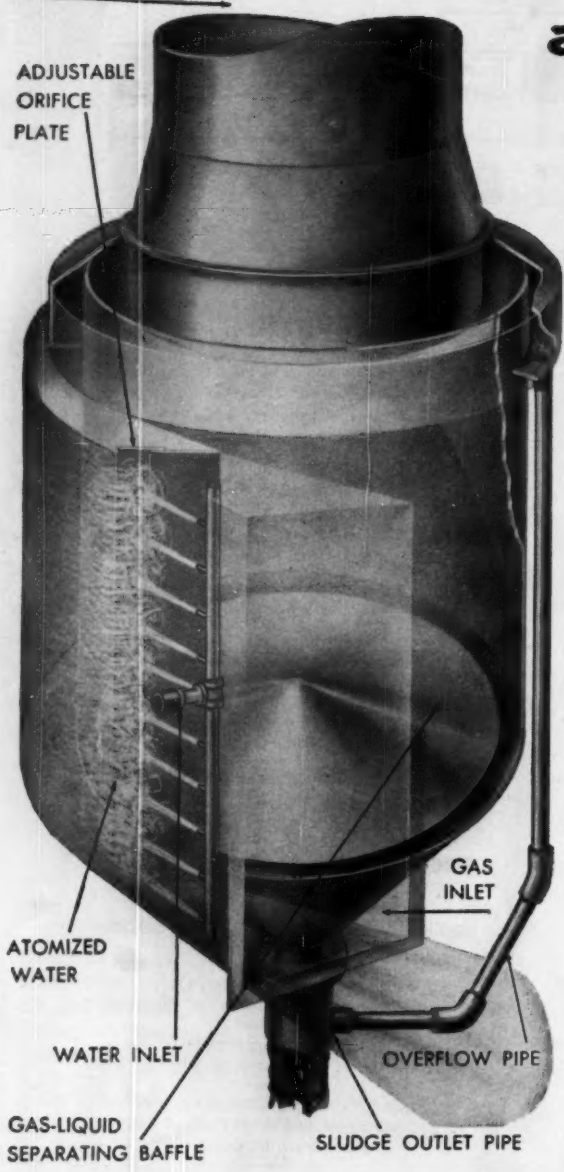
WRITE FOR REYNOLDS DATA FILE
Aluminum for Chemical Process Uses



Reynolds Metals Company
P.O. Box 2346-CJ • Richmond 18, Virginia

Please send me your free data file on Aluminum for Chemical Process Applications.

*Name*_____
*Company*_____
*Address*_____
*City*_____ *Zone*____ *State*_____



a NEW scrubber for ultra-efficient dust and fume control

THE DUCON TYPE VO Oriclone® SCRUBBER

- 50% less space requirements than other high energy scrubbers.
- Higher operating efficiency at lower horsepower.
- Adjustable orifice maintains peak efficiency when operating conditions vary.
- Economical in first cost and operating cost.
- Simplicity of design permits economical alloy construction or acid brick lining.
- 99% efficiency below 2 micron and in sub-micron range.

The Ducon Type VO Oriclone Scrubber—the only high energy scrubber with an adjustable orifice—is the most effective and most economical dust and fume collector for a wide range of industrial applications, including recovery of catalyst dust, cupola dust and fumes, acid mists, tar fog and many others.

The Oriclone Scrubber is a completely integrated unit that performs the entire separation cycle. No subsequent collector is needed.

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the name in DUst CONtrol

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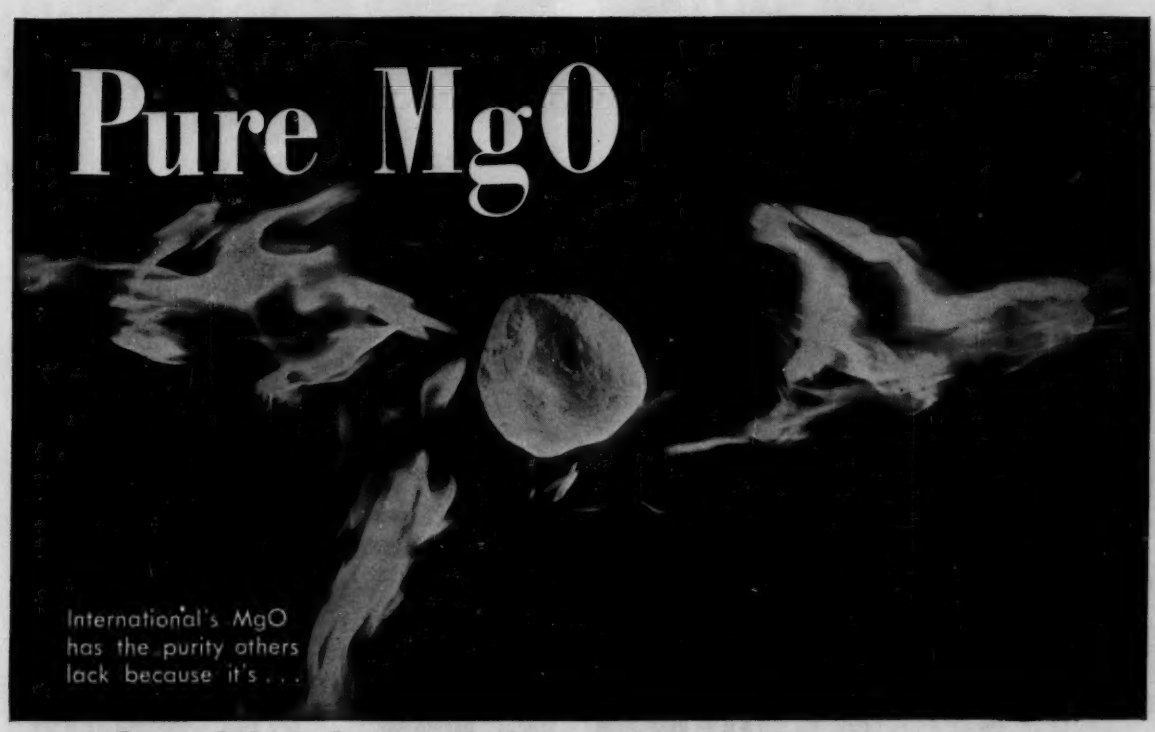

produced by thermal decomposition

Disappointed with conventional magnesium oxides? Then try International's. *It's the only MgO produced by thermal decomposition.* And the difference is amazing! Electrically furnaced, this MgO has achieved the highest resistivity and refractory properties of any commercially available magnesium oxide.

You'll find International MgO relatively low in cost. Now improved production facilities are geared to produce any quantity you need.

For further details, fill out and mail the coupon . . . you can count on a prompt reply.

Here's how IMC does it!

CONVENTIONAL PROCESSES

↓

Magnesium Chloride $MgCl_2$
(Contained in sea water, well brine, bittern.)

+

Lime CaO
(Contained in dolomite, sea shells, etc.)

↓

Magnesium Hydroxide $Mg(OH)_2$ + heat

↓

Magnesium Oxide MgO

INTERNATIONAL'S UNPARALLELED PROCESS

Magnesium Chloride $MgCl_2$ + heat

↓

Magnesium Oxide MgO + Hydrochloric Acid HCl

↓

heat → MgO

And here's the result!

MgO	99.5%	Cl	0.03	Density .... 75 lbs./cu. ft.
S_1O_2	Nil	CaO	0.05	*Low Boron, too, upon request!*
SO_4	0.03	Fe_2O_3	0.05	

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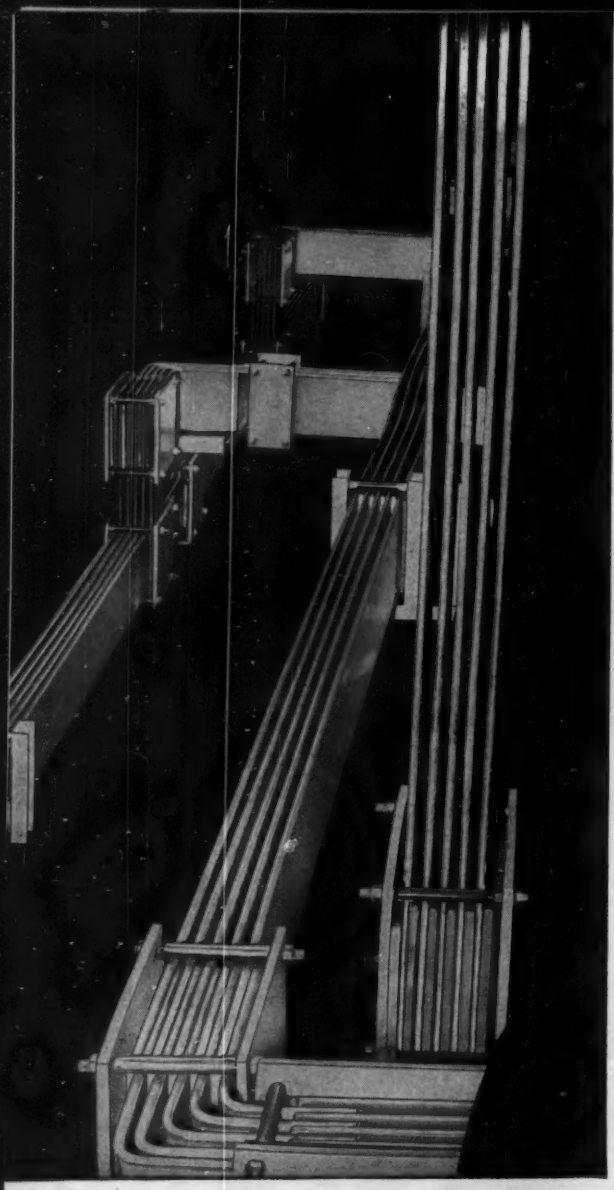
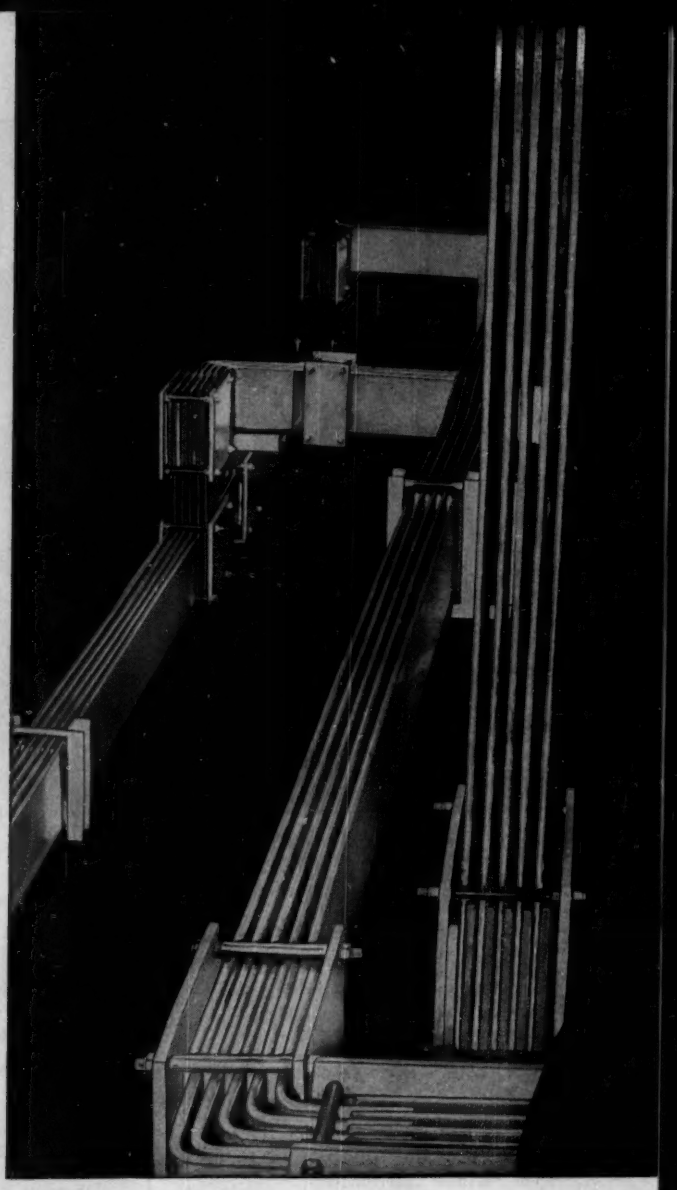




WITH ALCOA ALUMINUM BUS CONDUCTOR...

twice as much for the same price

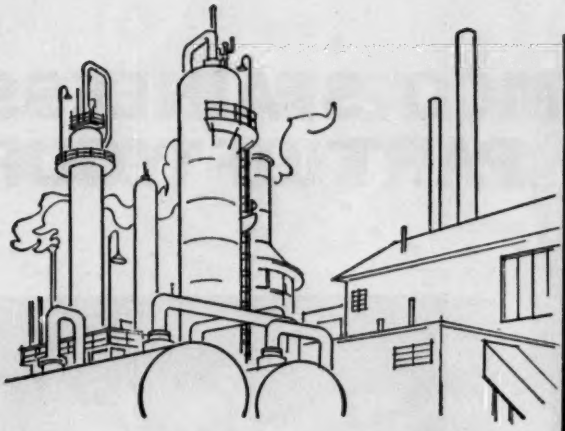
IT'S TRUE—for conductors with the *same* electrical and heat-dissipating ratings, you can buy, today, *two* feet of Alcoa bus for the price of just *one* foot of copper.

BUT MATERIAL cost is only part of the story. Lightweight Alcoa® Aluminum Bus Conductor handles more easily and requires less costly supporting structures. It's easier to bend and form to your needs. Millions of pounds of aluminum bus are in service today in all types of industry.

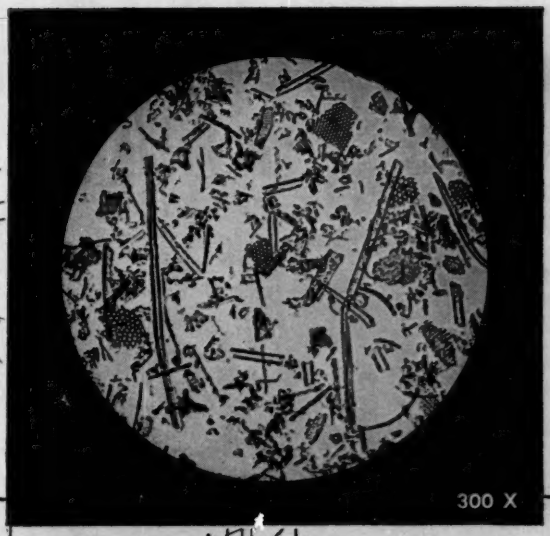
SO WHY ever use *any* bus except Alcoa Aluminum? There's not a reason in the world . . . not these days! For up-to-date facts and figures on how much *you* can save, call Alcoa or your Alcoa Distributor. Aluminum Company of America, 2120-L Alcoa Building, Pittsburgh 19, Pennsylvania.

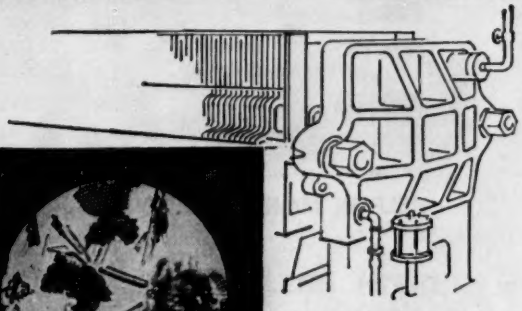
Write on company letterhead for *Alcoa Aluminum Bus Conductor Handbook*

ALCOA
ROME CABLE DIVISION



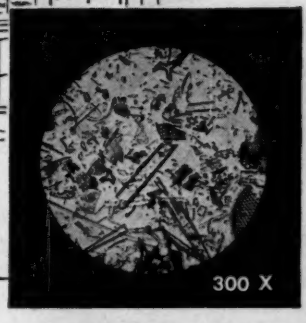
For flow rate plus clarity—Hyflo Super-Cel has the right combination of large and fine particles. Heavily used in chemical processes such as caustic soda production.





For fast flow rates—Celite 545 has a higher proportion of coarse particles. Frequently used for clarification of resins and other viscous liquids.

For maximum clarity—Filter-Cel has a relatively fine particle size distribution. Used in producing lard, salad oil, other hydrogenated oil products.



In diatomites, Johns-Manville precision processing works for you

Celite has the exact grade for every filtration need from fast flow rate to maximum clarity

Study samples of various filtration grades of Celite* diatomite with the unaided eye. Rub them between your fingers. One grade looks, feels very much like another.

Then compare these grades under the microscope. Each has its own distinctive particle size distribution. Each is precision-milled to fill the most exacting filtration requirements, ranging all the way from maximum flow rate to maximum clarity.

Celite 545, for example, with a higher proportion of large to fine particles, is used to remove large suspended impurities at maximum flow rates. *Hyflo Super-Cel®* has a balanced particle size distribution, combines good liquid clarity and moderate flow rate. But *Filter-Cel®* has a much higher ratio of small particles, is tailored for use where high clarity outweighs flow rate.

Whatever your filtration problem—Johns-Manville can furnish the "right" grade for the job. You have a choice of 9 intermediate grades *plus* many special grades. Each comes from the largest and purest commercially available deposit. Each is processed and graded at the same plant under the same uniform conditions.

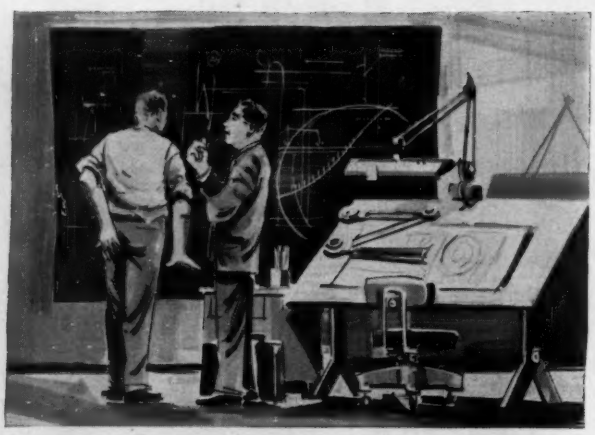
For information on specific filtration or mineral filler problems, talk to your nearby Celite engineer, or write to us. Johns-Manville, Box 14, N. Y. 16, N. Y. In Canada, Port Credit, Ont.

*Celite is Johns-Manville's registered trademark for its diatomaceous silica products

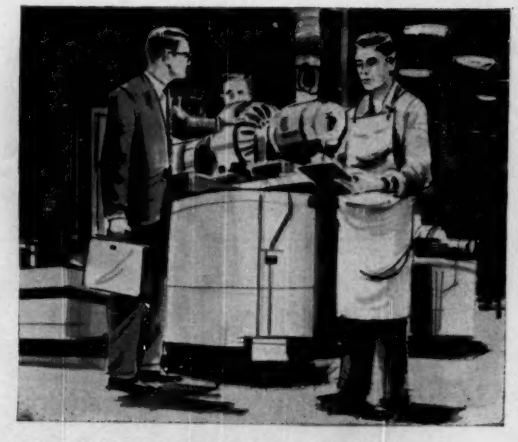
JOHNS-MANVILLE

ARMCO STEELS / for chemical processing equipment

MAKE YOUR ARMCO STAINLESS PART OF YOUR



MATERIAL SELECTION



HELP IN MAINTENANCE PLANNING

In your planning for new equipment, for scheduled maintenance or when emergencies threaten shutdown, your distributor of Armco Stainless Steels can help save you money.

At the planning stage for new plants or equipment, your distributor's mill trained engineers and salesmen, backed by Armco research and engineering staff, can provide valuable assistance in grade selection and fabrication procedures. Standard stainless steels as well as Armco 17-4 PH, 17-14 CuMo, the ELC grades and other special Armco Stainless Steels are being widely used to eliminate materials problems in chemical processing equipment.

In your regular plant maintenance program, your Armco Distributor also offers valuable cost-cutting help. His complete stocks of Armco Stainless Steels provide you with a storage-free but extensive inventory of stainless steel. And his many supplementary services can be integrated with your maintenance facilities to further cut costs.

Your Armco Stainless Steel Distributor's big inventory, experienced personnel, and fast service are most valuable when emergencies threaten shutdown. If he is familiar with your requirements and you know exactly how he can serve you, costly production delays can be avoided at minimum cost.

Make your Armco Stainless Steel Distributor a member of your cost-cutting team by getting in touch with him today.

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PENNSYLVANIA
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Edgcomb Steel Co. (AB)
Peter A. Frasse & Co., Inc. (AB)
Pittsburgh
William M. Orr Co., Inc. (AB)
York
Edgcomb Steel Co. (AB)
York Corrugating Co. (A)

RHODE ISLAND
Providence
Congdon & Carpenter Co. (AB)

SOUTH CAROLINA
Greenville
J. M. Tull Metal & Supply Co. (AB)

TENNESSEE
Memphis
Metal Goods Corp. (AB)

TEXAS
Dallas
Earle M. Jorgensen Co. (AB)
Metal Goods Corp. (AB)
Moncrief-Lenoir Mfg. Co. (AB)
Harlingen
Moncrief-Lenoir Mfg. Co. (AB)
Houston
Earle M. Jorgensen Co. (AB)
Metal Goods Corp. (AB)
Moncrief-Lenoir Mfg. Co. (AB)
Lubbock
Moncrief-Lenoir Mfg. Co. (AB)
San Antonio
Moncrief-Lenoir Mfg. Co. (AB)
Temple
Moncrief-Lenoir Mfg. Co. (AB)

WASHINGTON
Seattle
Ducommun Metals & Supply Co. (AB)
Electric Steel Foundry Co. (AB)
Earle M. Jorgensen Co. (AB)
Spokane
Electric Steel Foundry Co. (AB)

WASHINGTON, D. C.
York Corrugating Co. (A)

WISCONSIN
Milwaukee
Central Steel & Wire Co. (AB)

DOMINION OF CANADA
Montreal, Quebec
Firth-Brown Steels, Ltd. (AB)
Toronto, Ontario
Firth-Brown Steels, Ltd. (AB)
Vancouver, B. C.
Esco, Ltd. (AB)

ARMCO STEEL

Armco Division • Sheffield Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation

Replace Complete Trim Without Removing Valve From Line!

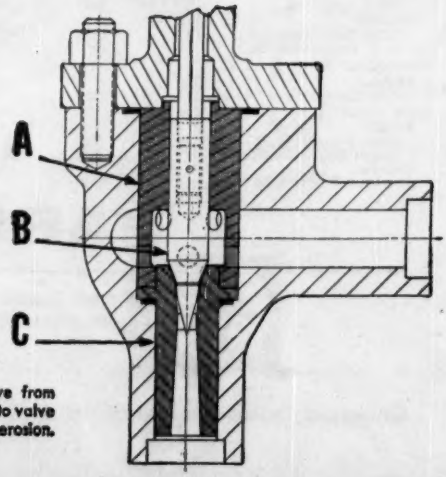
Rockwell-built Republic V-10 valves with Quick-change Trim save many hours of downtime on severe energy conversion applications with pressure drops up to 3500 lbs.

The Republic V-10 angle valve for high-pressure liquid or steam regulating services offers unique valve maintenance advantages because of its Quick-change Trim construction.

Quick-change Trim in the V-10 valve makes it possible for you to replace the valve seat, inner valve and guide in little more time than is required to dismantle and reassemble a bolted joint. No time is required for lapping the seating surfaces of the valve, since this is done in advance. *And you can make this quick trim change in minutes without removing valve from the line.* The savings to you are considerable in downtime and maintenance expense.

Republic V-10 Valves are available with either welded seat or replaceable seat, in addition to the Quick-change Trim design, with bolted or pressure seal bonnets. V-10 valve contours are designed to produce not only the desired regulating characteristics, but also to reduce erosion damage and noise as well. Precise manufacture and long-life materials make Republic regulating valves perform better, last longer, with less maintenance. For additional information, contact your nearest Republic Representative, or write to Republic Flow Meters Company, 2240 Diversey Parkway, Chicago 47, Illinois. In Canada: Republic Flow Meters Canada, Ltd., Toronto. Subsidiary of Rockwell Manufacturing Company.

Rockwell-Republic V-10 regulating valve with Type J-1 positioner is designed for rugged high-pressure liquid or steam service.



Quick-change Trim feature makes it possible to replace the seat guide (A), inner valve (B), and seat (C), without removing valve from the line. Seat extends to valve outlet to prevent body erosion.

REPUBLIC INSTRUMENTS AND CONTROLS
more fine products by
ROCKWELL

DEMING VERTICAL TRANSFER PUMPS

deliver solvents and thinners from underground tanks to factory

Pratt & Lambert, Inc., well known paint and varnish makers in Buffalo, N. Y. recently changed the company's entire method of storing and handling solvents and thinners...with the help of eighteen Deming 4703 Vertical Transfer Pumps.

With the construction of a new arterial highway, it was necessary to remove above-ground storage tanks and replace them with eighteen 12,000 gallon underground tanks. Each underground tank is equipped with a Deming Fig. 4703 Vertical Transfer Pump with a 5 HP explosion proof motor. The solvents and thinners are pumped from the underground tanks as needed, through as much as 900 ft. of 2 inch pipe to factory dispensing tanks, with elevations up to 80 feet. Push-button controls operate the individual pumps.

RESULT: Tank cars now can be unloaded by gravity and considerable time is saved in pumping operations through use of the individual pumps and controls. In addition, the hazards of above-ground storage are eliminated.

Bulletin No. 4700 G describes the complete line of Deming Industrial pumps with emphasis on pumps for Gasoline, Jet Fuel, Industrial Solvents and similar liquids. Clip and mail coupon for your copy.

NAME_____

COMPANY_____ POSITION_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

The DEMING Co.

487 BROADWAY • SALEM, OHIO

GILBARCO'S ELECTRONIC GAUGE

...the only measuring instrument that provides complete automation in gauging liquids and solids!

The Gilbarco Electronic Tank Gauge will indicate the level of most substances having a dialectric constant of 1.5 or higher, which covers virtually every solid and liquid known. Readings can then be transmitted over any distance to a remote station equipped with read-out recorders or data-loggers.

Case histories demonstrate its flexibility...

✔ At a major sugar refinery, a Gilbarco gauge met with acceptable results during a test period...assisting in the automation of this modern plant, a group of gauges will be used to measure continuous sugar level in storage silos.

✔ Polyethylene cubes have been measured successfully.

✔ An electric power plant has purchased a Gilbarco tank gauge for remote measurement of powdered soft coal in feed hoppers.

✔ Gauging of molten sulphur is another application where the Gilbarco unit is being considered.

Alcohol, asphalt, flour, wood pulp, corn and food starches are but a few of the endless commodities that can be measured. Regardless of your product, write to Gilbarco about *your* level measurement problem...

Gilbarco

GILBERT & BARKER MFG. COMPANY
West Springfield, Massachusetts

JUST PLAIN

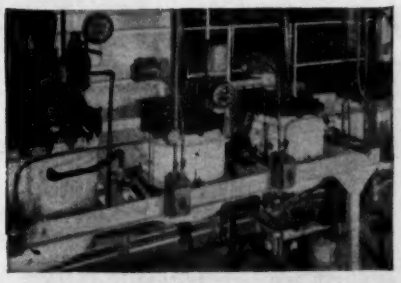
TOUGH!

Rust-Oleum
HEAVY-DUTY
CHEMICAL RESISTANT
Coatings

For use where the going is TOUGHEST

This modern, new Rust-Oleum development is best described by three old-fashioned words—*JUST PLAIN TOUGH!* These Heavy-Duty Chemical Resistant Coatings are specially formulated for use where the going is toughest—on unpainted metal, wood, or masonry surfaces—on conveyors, equipment, machinery, pipes, structural steel, tank exteriors, walls and ceilings. Resistant to most acids, alkalis, chemicals, hydraulic fluids, machine coolants, jet fuels, oil, gasoline, aliphatic and aromatic solvents. Equally important—Rust-Oleum Heavy-Duty Chemical Resistant Coatings *really stick to unpainted concrete floors.* Available in practical and pleasing pastel colors!

Your nearby Rust-Oleum Industrial Distributor has complete stocks for prompt delivery. Ask him for complete details, including a free test application, or write us for the facts.



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Distinctive as your own fingerprint. There are imitations, but only one Rust-Oleum.

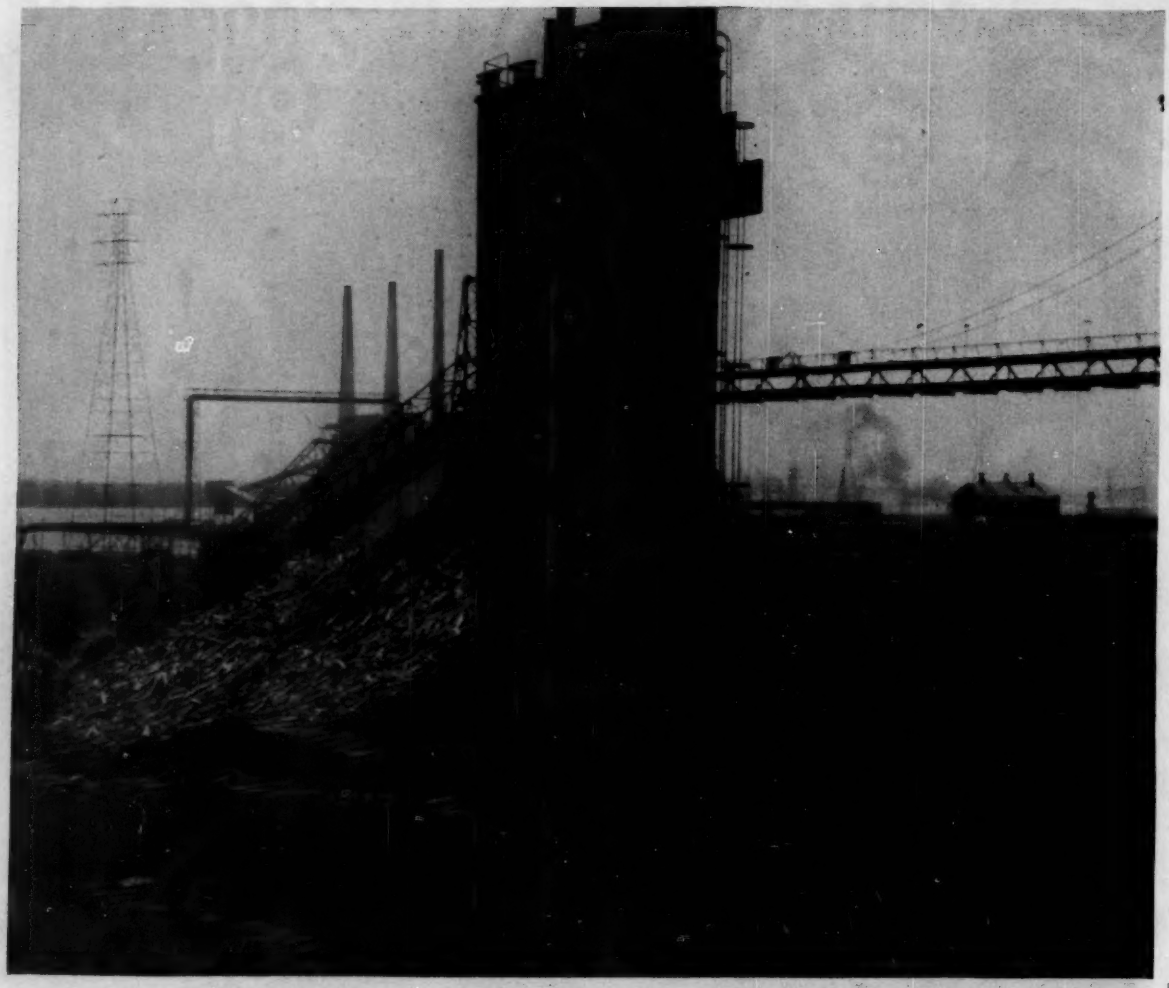
STOPS RUST!®

ATTACH TO YOUR LETTERHEAD

Rust-Oleum Corporation
2512 Oakton St., Evanston, Ill.

☐ Complete details, including actual color charts and applications.

☐ Free test application on my own metal, wood, or masonry surfaces.



Wet SO_2 line now in 4th year ...proves superiority of Ni-O-Nel alloy

. . . handles severely corrosive hot acids and oxidizing chemicals, too

That return gas line running down between the Jenssen acid towers shown above has been working there since 1955. It is at Scott Paper Company's Detroit plant.

The line is 16 inches in diameter and 77 feet long. Yet it was put up with no intermediate supports. It needed none, because of the extra strength and rigidity that Ni-O-Nel nickel-chromium-iron alloy provides.

This line carries wet SO_2 between the towers handling weak and strong acids. It's an outstanding replacement where a previous pipe failed. Periodic inspections reveal no leaks or need of maintenance.

Remarkable resistance to severe corrosives

Ni-O-Nel alloy has demonstrated in both laboratory and industry remarkable resistance to hot acids and oxidizing chemicals.

Chemical processors find it useful in handling hot sulfuric acid pickling baths, phosphoric acid up to 280° F, boiling organic acids such as acetic, phthalic and maleic, and nitric acid solutions at practically all temperatures and concentrations.

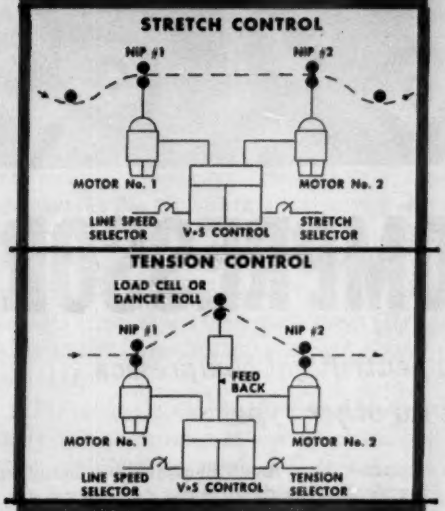
Ni-O-Nel alloy is also useful in salt water service. It resists pitting and chloride ion stress corrosion cracking.

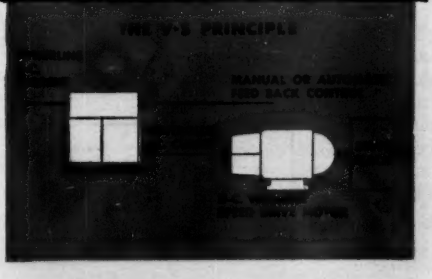
For information on the engineering properties of Ni-O-Nel alloy and detailed data on its record of corrosion resistance, write for a free copy of "The Corrosion Resistance of Ni-O-Nel." *Inco trademark

HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

NI-O-NEL®

How to Control Tension and Stretch on Web Processes





Reliance Variable Speed Drives will accurately control stretch and tension on web processes such as tire cord dipping, paper making, or plastic film manufacturing.

A Reliance Variable Speed Drive is all electric and operates from a-c. circuits. It consists of motor controls and one or more d-c. drive motors. Speed, horsepower and torque are controlled and changed by regulating the voltage and current supplied to the drive motors. By tying the controls to a system feedback, process regulation becomes completely automatic.

CONTROLLING THE WEB

Reliance V★S Drives control web stretch by maintaining drive motor speed differential. One motor driving a pinch roll or capstan is made to turn faster than the preceding pinch roll motor. By closely regulating this speed differential, elongation of the web is precisely controlled.

Tension control is a different problem. Here a specified amount of pull is exerted on the web, regardless of elongation. A load cell or a dancer roll provides a feedback signal to regulate the drive motors.

SPEED AND TORQUE CONTROL

In controlling tension, drive motor torque is held constant, and speed is varied to accommodate variation in elasticity. Stretch control is maintaining a set drive motor speed differential, and varying torque to accommodate variations in elasticity.

This is one of the many chemical applications of V★S Drives. For further information on Reliance Variable Speed Drives, ⅛ through 200 hp., contact your Reliance Representative, or write for Bulletin No. D-2506. D-1002A

Product of the combined resources of Reliance Electric and Engineering Company and its Master and Reeves Divisions

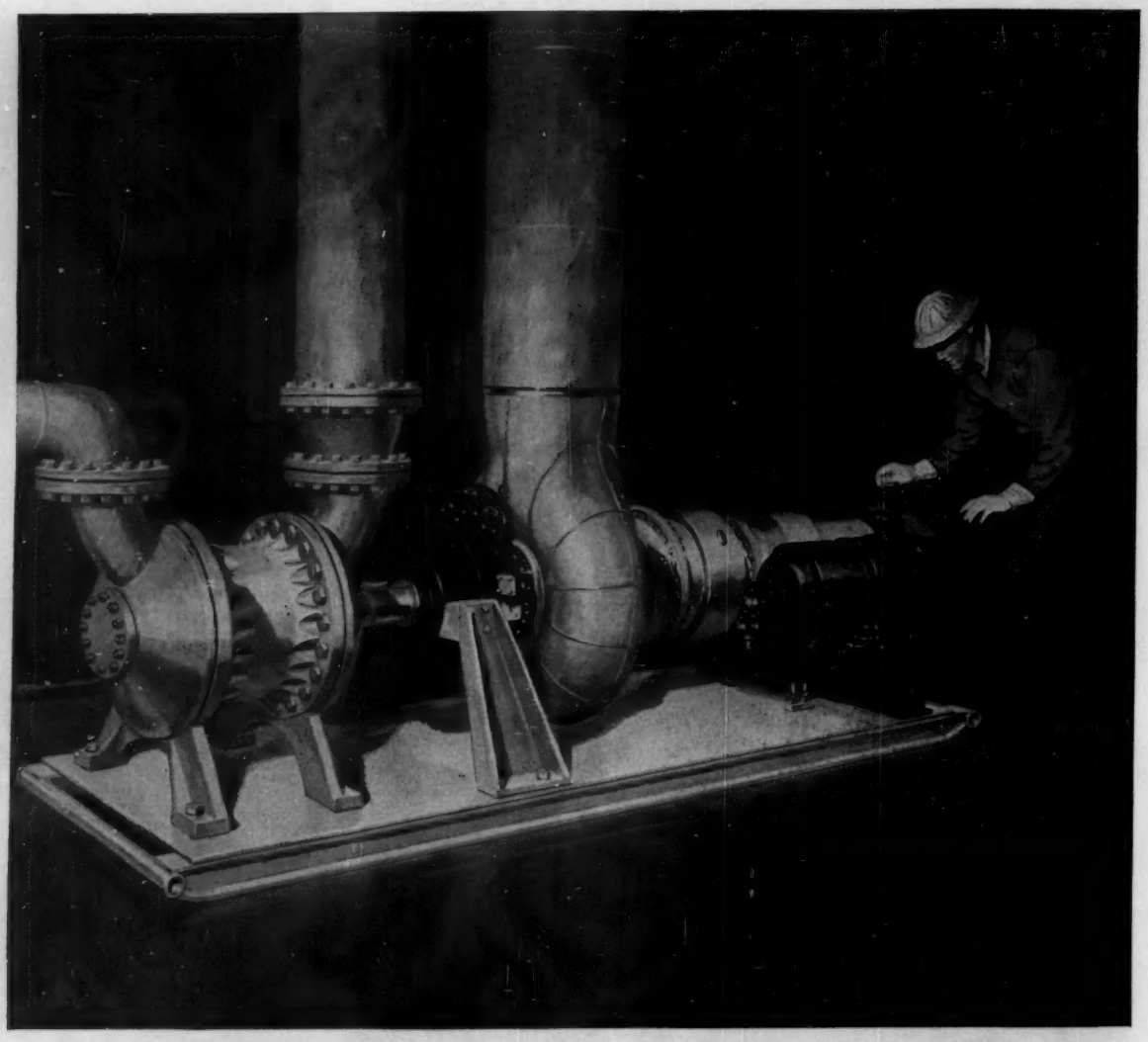
RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 134A, CLEVELAND 17, OHIO

Canadian Division: Toronto, Ontario

Sales Offices and Distributors in principal cities

Duty Master A-c. Motors, Master Gearmotors, Reeves Drives, V★S Drives, Super 'T' D-c. Motors, Generators, Controls and Engineered Drive Systems.



UNIQUE NEW COMPRESSOR

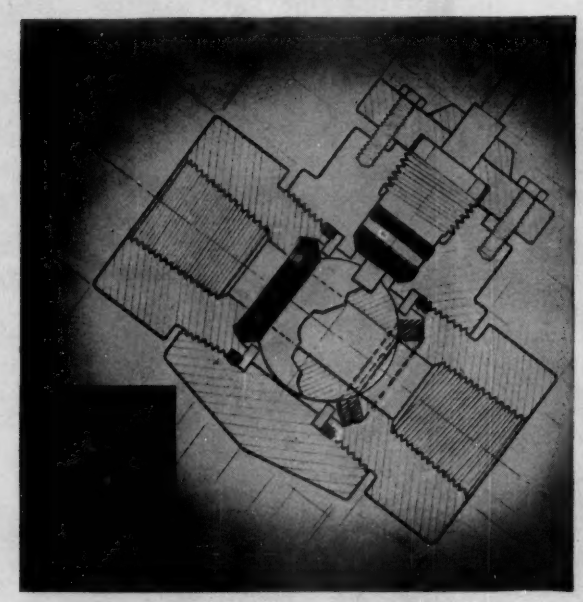
Solar industrial gas turbine-driven centrifugal compressor offers advantages found in no other type

SOLAR'S LIGHTWEIGHT centrifugal compressors incorporate unique new features for applications in the low-volume range. They operate in a range of flows and pressures new to centrifugal equipment. Interchangeable compressor wheels and other parts permit quick, low-cost field changes to accommodate new flow and pressure requirements. Ideal for main pipeline stations as well as field use, they can be started or shut down in seconds—even by remote control—and are ideal for unattended operation.

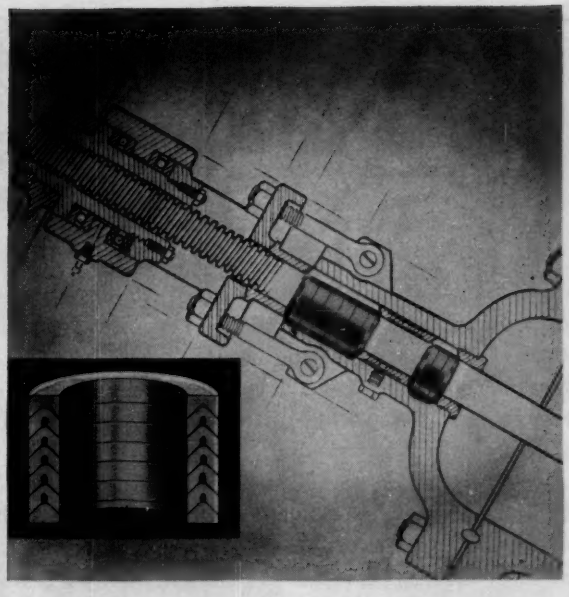
Designed to match the high rotating speeds of Solar gas turbine drivers, Solar's new compressor packages are small and lightweight (a fraction of the weight of conventional piston-driven units). They require only the lightest foundations. Maintenance is simple. Easy portability allows periodic inspection at a central shop.

A new illustrated brochure describes in detail Solar centrifugal gas compressors. Write for it to Dept. G-190, Solar Aircraft Company, San Diego 12, California.

SOLAR
AIRCRAFT COMPANY



Seats and stem gaskets of TFE resin assure tight-sealing, no-stick operation in these non-lubricated ball valves used in high-pressure butane-propane service. These valves have been in operation for three and one-half years, with no leakage or valve failure.



V-ring packings of a TEFLON TFE resin in valves for paper-mill service eliminate the frequent changes of packing and periodic adjustments formerly required. In addition, losses of corrosive liquor are eliminated and wear on valve stems is sharply reduced.

Maintenance and replacement costs reduced with packings and gaskets of TEFLON® TFE resins

The two examples above typify the cost-cutting advantages of TEFLON fluorocarbon resins as packing and gasket materials. In all applications TEFLON resins provide long service life . . . with resultant savings in maintenance and replacement costs, plus increased productive capacity due to less downtime. TEFLON resins are not affected by materials being processed. Their low-friction characteristics often permit their use without lubrication, minimize torque requirements, and reduce wear on pistons and shafts.

TFE resins are the established standards where reliability over a wide range of severe conditions is important. They are rated for continuous service at 500°F. FEP resin is the new melt-processible member of the family of TEFLON fluorocarbon resins. It can be molded and extruded like nylon, polyethylene and other familiar resins. FEP resin is capable of continuous service at 400°F.

In many applications, TEFLON fluorocarbon resins have been found to be the only material that would give satisfactory performance. But even when service demands are not exceptionally rugged, the properties and versatility of TEFLON TFE and FEP resins permit plant-wide standardization for packings and gaskets in chemical service.

For more information about the wide variety of forms in which TFE and FEP resins are available for sealing applications, consult your supplier. And for additional information about properties and characteristics of TEFLON resins and the many ways they have led to improved, economical designs, write to: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department T 10418, Room 2526, Nemours Building, Wilmington 98, Delaware.

• • •

In Canada: Du Pont of Canada Limited, P. O. Box 660, Montreal, Quebec.

DU PONT REG. U.S. PAT. OFF.

TEFLON®

FLUOROCARBON RESINS

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

TEFLON is Du Pont's registered trademark for its family of fluorocarbon resins, including TFE (tetrafluoroethylene) resins and FEP (fluorinated ethylene propylene) resin.

For tough expansion problems—

ANACONDA
A-X TUBING

Anaconda A-X tubing is a flexible metal connector with annular corrugations designed to handle the types of movement shown at the right while conveying liquids or gases. It is available in stainless steel and other alloys and is generally sold complete with fittings (right, below). Nominal tubing I.D.'s: 5", 6", 8", 10", 12", 14".

Most axial motion applications involve motion in one direction in respect to the installed position. This may result in compression or extension of the tubing. In a few applications an assembly may be subjected to both extension and compression in relation to the installed length – such cases occur when temperature varies both above and below installation temperature. In order to give the best service for each type of application there are three different corrugation standards for each tubing size:

PRE-COMPRESSED. Designed for extension movement. Will allow a small amount of compression.

STANDARD. Designed for compression movement. Will allow a small amount of extension.

OPEN PITCH. For elbow forming, ducting, or misalignment where little movement is required.

60123

Bulletin A-X 97 gives complete details. Call your Anaconda Metal Hose representative for a copy—or for the services of an Anaconda specialist to help you in the design of a special connector to meet your needs. Or send in coupon below.

ANACONDA® METAL HOSE

Anaconda Metal Hose Division **CE**
The American Brass Company
Waterbury 20, Conn.

Please send a copy of Bulletin A-X 97

NAME.....

COMPANY.....

STREET.....

CITY..... **ZONE**..... **STATE**.....

BASIC STANDARD UNIT

TYPES OF MOTION

AXIAL

RADIAL

DUAL-RADIAL

SHEAR

FITTINGS FOR A-X TUBING—UNBRAIDED

INTEGRAL END

UNW WELDING NIPPLE

FW—FIXED FLANGE

FFW—FLOATING FLANGE

FITTINGS FOR A-X TUBING—BRAIDED

UNW—WELDING NIPPLE

FW—FIXED FLANGE

FFW—FLOATING FLANGE

NEW!

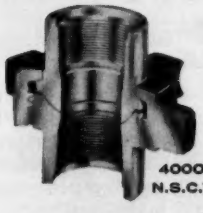
For Oil Field Applications

Color Coded

. . . quickly indicates pressure rating and type of seat

CM Hi-Pressure

Handlebar UNIONS



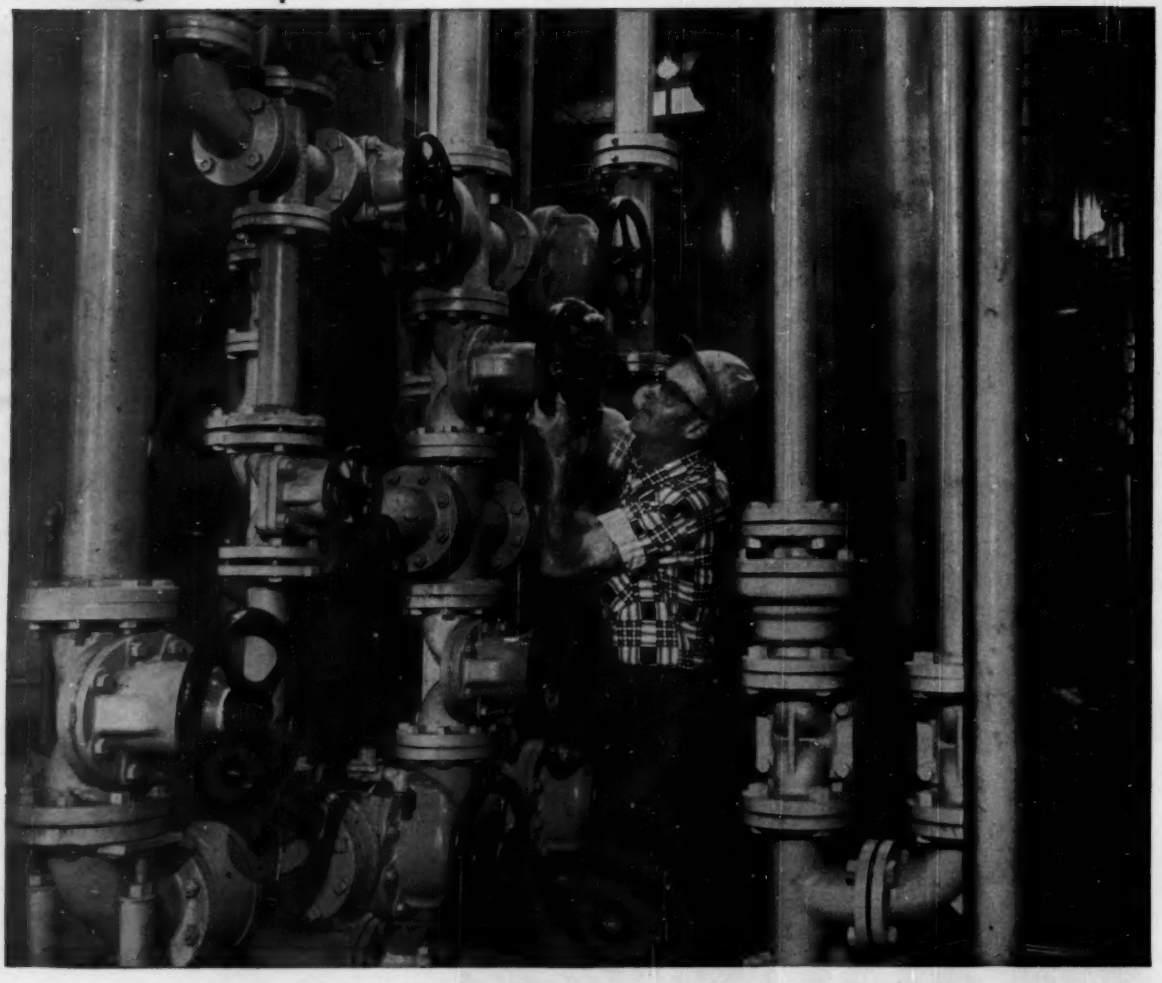
with 3-pitch Standard Acme thread

Fast acting! Rapid make and break! Color coded for quick identification! Everything about the new CM "Hi-Pressure" Handlebar Unions is designed to give easy, snappy service in the oil processing field . . . where time counts. With a metal-to-metal seat, the CM "Hi-Pressure" Handlebar Union withstands 4000 p.s.i. With the new "O" ring, this union offers a *dual* seal of rubber-to-metal and metal-to-metal with a rating of 6000 p.s.i. Available in 2" size, these unions have wide application in the petroleum industry. Offer the newest and the best on the market today . . . the CM "Hi-Pressure" Handlebar Union!

Write today for complete information on CM Unions!

CLAYTON MARK & COMPANY
1900 Dempster Street • Evanston, Illinois

DOW | **SARAN LINED PIPE**



5 miles of pipe, 12 years of service

Saran Lined Pipe keeps process acids flowing!

When five miles of process piping must carry an unfailing flow of highly corrosive acids, thorium salt solutions and slurries . . . when frequent flow changes require quick, on-the-spot pipeline modifications . . . that's when the extreme corrosion resistance and easy workability of Saran Lined Pipe make this process pipeline a process lifeline.

Above is one section of the approximately five miles of Saran Lined Pipe which carries process chemicals in thorium recovery operations at the American Potash & Chemical Corporation's Lindsay Chemical Division plant, West Chicago, Illinois. In this process, Saran Lined Pipe is required to carry highly corrosive materials: sulphuric acid slurries for ore leaching; reacted thorium sulphate solutions and waste slurries; concentrated hydrochloric acid, hydrofluoric acid slurries. The pipe network has been in constant use since 1947, and *there's never been a major process shutdown because of pipeline failure!*

Equally as important to Lindsay as corrosion resistance are the workability and strength of Saran Lined Pipe. The nature of the process requires frequent flow changes, meaning frequent changes in piping. Necessary pipeline modifications are done quickly and easily by plant personnel, cutting process downtime to a matter of hours. And high physical strength of the pipe minimizes the need for extensive pipe supports!

Saran Lined Pipe, fittings, valves and pumps are available for systems operating from vacuum to 300 psi, from below zero to 200°F. They can be cut, fitted and modified easily in the field without special equipment. For more information, write Saran Lined Pipe Company, 2415 Burdette Ave., Ferndale, Michigan, Dept. 2283AK4-18.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

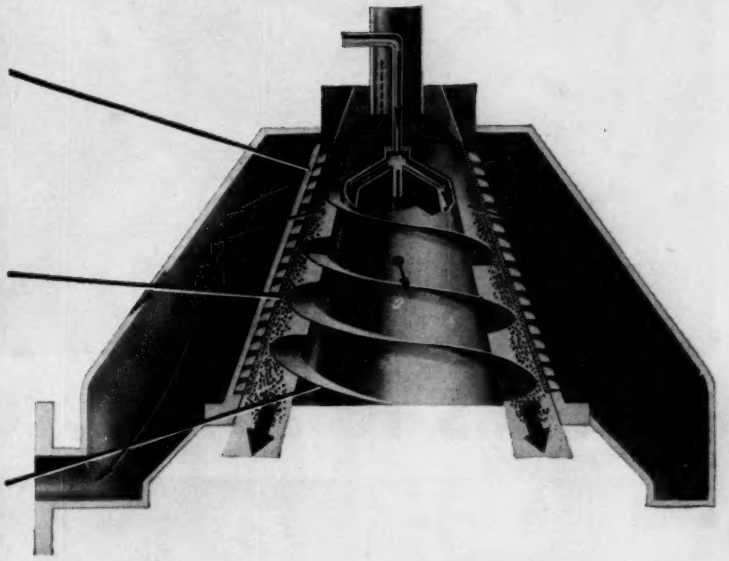
See "The Dow Hour of Great Mysteries" on NBC-TV

1 2 3

the separating action of high centrifugal force (1800 x G) as the conical bowl assembly rotates at high speed.

the filtering action of the special perforate plate on which the solids are deposited and through which the mother liquor passes.

the metering action of the differential volute which controls the flow of solids downward at desired proper rate.



forces act on your slurry at the same time in the Sharples Continuous Dehydrator

For deliquefying crystalline solids and fibrous pulps at high capacity, Sharples offers 4 sizes of the Continuous Dehydrator with solids handling capacity up to 70 tons or more per hour.

A wide range of variables is inherent in the design and operation of this centrifuge; refinements which reflect in superior performance on each specific material.

The Sharples Continuous Dehydrator has proved to be an effective and profitable answer in numerous high capacity dewatering jobs. Get in touch with Sharples . . . specialists in making the most of solids from slurries.

We'll gladly send literature on the Continuous Dehydrator.

THE SHARPLES CORPORATION

Centrifugal and Process Engineers

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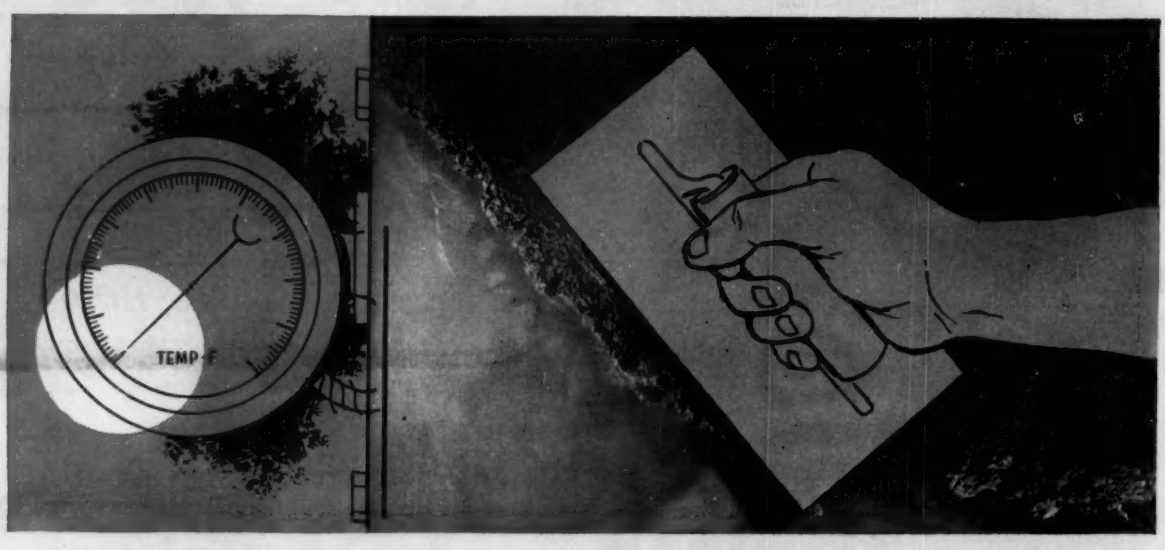
Associated Companies and Representatives throughout the World

IT STICKS TO HOT OR COLD SURFACES!



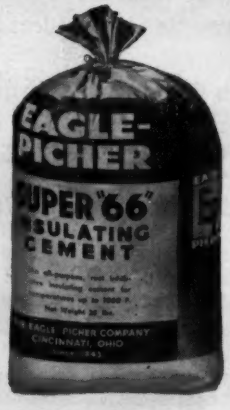
EAGLE-PICHER
SUPER "66"
INSULATING CEMENT

Eagle-Picher produces a complete line of industrial insulations for all temperatures from below Zero to over 2000 F.

EAGLE EP PICHER

Since 1843

The Eagle-Picher Company
Dept. CE 4-18
General Offices: Cincinnati 1, Ohio



Here's why you save money when you use Eagle-Picher Super "66" Insulating Cement

- Because it sticks, Super "66" saves time — applies quickly to any equipment, cold or hot. Effective up to 1800°F. . . . and it contains a special rust inhibitive which actually prevents corrosion !
- Because it sticks, Super "66" saves money— provides far greater coverage and more efficient insulation.
- Because it sticks, Super "66" makes difficult jobs easy—can be used on irregular shapes where application of other insulations is often impossible. Usually requires no reinforcing on applications up to 1½ inches thick.

FISCHER & PORTER

THE HIGHEST POSSIBLE QUALITY

AROUND THE PNEUMATIC CONTROL LOOP WITH FISCHER & PORTER INSTRUMENTS

There are those who would have you believe our manufactory naught but the foremost maker of FLOWMETERS. But we cry, "NOT SO". And we have the courage to offer proof of an exceedingly extravagant nature to support our earnest denials. Proof, if you will, that the bonds of our PRODUCT LINE extend far beyond the limits of the estimable FLOWMETER.

Envisage, Sirs, a "pneumatic control loop". Here, for example, we offer instruments to measure not merely flow, but also temperature, pressure, level, density, viscosity, and consistency.

Notice how Fischer & Porter devices are available to convert the diverse outputs of these many measuring instruments to clear and accurate pneumatic signals to be sent whistling through pipes to the heart of the loop . . . the control center.

Now note the multiplicity of Fischer & Porter instruments diligently performing their assigned tasks at the control panel. There are large and small case instruments with controllers tucked inside. There are miniature instruments with controllers riding piggy-back.

Surely, it beggars description. Yet this represents but a modest sketch of our line. For we are an INSTRUMENT COMPANY. And we pride ourselves on the availability of an instrument to fit every kink in the knottiest control loop.

Need we say more? Have we convinced you? Perhaps not!

But may we recommend that you spend a few precious moments with our Catalog Number Two? It is a brief presentation of our standardized instruments, and has won the hearts of instrument users everywhere. May we send you a copy for your own use?

They Are All Buying F&P Temperature And Pressure Transmitters With The Fiberglass Case!

ASK THEM WHY AND THEY WILL TELL YOU: They give the best results under all imaginable circumstances of use. There is a large clear indicating scale at the very point of transmission. Readily withstanding the onslaught of CORROSIVE acids, alkalis, salts, solvents, &c., they are proof against degradation by DUST and MOISTURE as well. So they have proved themselves in actual operation and are pronounced by those who have used them THE FINEST OF THEIR KIND!

COME ONE COME ALL
COME ONE COME ALL
TWICE THE TORQUE
TWICE THE TORQUE
NEW BELLOWS METER
NEW BELLOWS METER

This astounding new addition to the Fischer & Porter line has amazed the populace. Wherever it has been exhibited it has occasioned the selfsame response. Strong men cry! Ladies faint!

Do you ask why? Find a comfortable seat and observe the reasons:

Does it have twice the torque of old fashioned styles? YES! YES!

Does it eliminate mercury, seal pots, purges, &c.? YES!

Does it require leveling? NO!

Does it have full pressure rating overrange protection? YES!

Does it control? Transmit? Integrate? YES! YES! YES!

Does it exceed all others of its style in workmanship, precision, and all-around worthiness?

Modesty, gentlemen, prohibits a response But your interest will be rewarded with satisfaction. Our work is our bond!

PULSATION OUTWITTED

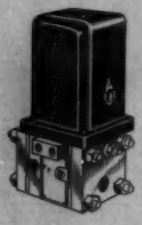
by the FISCHER & PORTER DP TRANSMITTER

No more overdamping! No more underdamping!

No more zero shift! No more phantom signals! No more diaphragm fatigue!

No more premature replacement!

This popular differential pressure transmitter undeniably supports its claim as being the best in the world! Ever since it was first presented to the public its success has been little short of remarkable. WHY? It must be that its superiority over all others is substantiated by the FACTS OF ACTUAL USE!



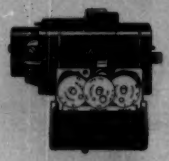
AMAZING ADVANTAGES
found in no like instrument

- Adjustable damping in the differential sensing system, Gentlemen, which is where it should be. We warrant there to be no other method that insures you the *fastest response*, eliminates *extraneous forces*, and wipes out *signal noise!*
- Process fluid CANNOT CONTACT any critical part whatsoever. A perfectly sealed measuring chamber filled with the celebrated silicone oil PROTECTS ALL WORKING PARTS.
- Its operation requires NO MERCURY! And it is a rugged, sturdy, all-metal structure that will serve you well in every respect through the years.

what will they think of next?
they will think of the

53P CONTROLLER!

that is what
they will think of next



- A true TRIPLE-THREAT controller! The same unit is used in large case instruments, plugged into miniatures, and for field mounting. TRUE standardization!
- In the most fastidious of processes it is an HONORED GUEST.
- Let this fine instrument speak for itself. But be advised that it SPEAKS IN A WHISPER, for it has a *non-bleed type* amplifying relay.
- It has the simplicity of motion balance design, which combined with the amazing REGENERATIVE FEEDBACK . . . provides the performance of force balance design.

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instruments
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____Temperature & Pressure Instruments
____Bellows Flowmeter
____Miniature Instruments
____53P Pneumatic Controller
____DP Transmitter

NAME: TITLE:

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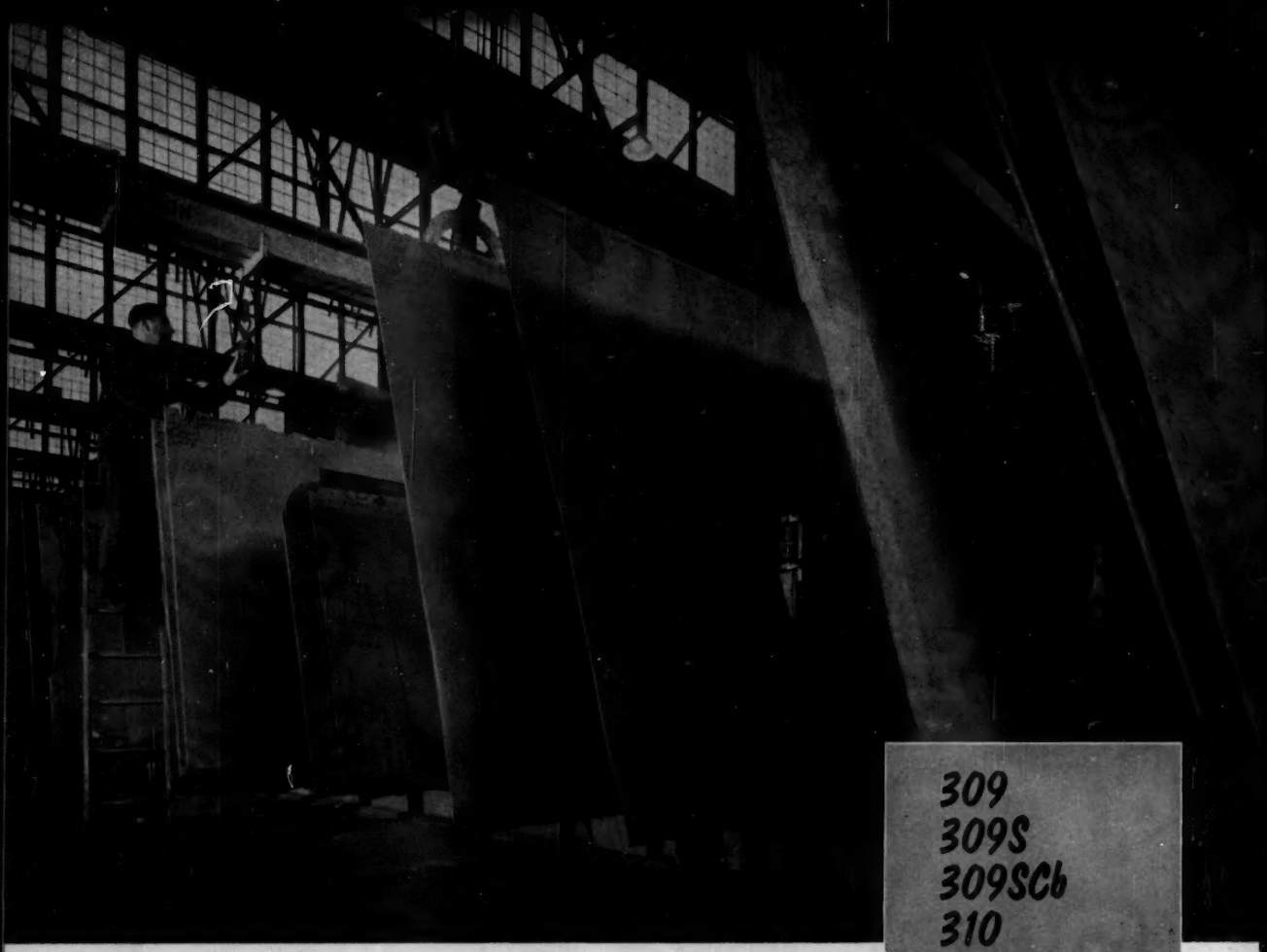
Fischer & Porter Co., Warminster, Pa. Dept. 23

state your pleasure, gentlemen!

To better acquaint our far reaching public with the BENEFITS and ADVANTAGES of our products we have caused to be printed handsome booklets for the general edification. We will gladly post to you a selection of these works upon your application. Make a selection at your leisure from the list below. Sign your name and address in the generous space provided, and send it to us. We are your obedient servants in this as in all other matters.

These MANUFACTURING AFFILIATES carry Fischer & Porter engineering designs to the far corners of the earth: FISCHER & PORTER (CANADA) LTD., DOWNSVIEW, ONTARIO. • FISCHER & PORTER LTD., WORKINGTON, CUMBERLAND, ENGLAND • FISCHER & PORTER G.m.b.H., GROSSELLERSHAUSEN, BEI GOTTINGEN, GERMANY • FISCHER & PORTER N.V., KONEETWEG 11, THE HAGUE, NETHERLANDS • FISCHER & PORTER Pty. LTD., 184 HANNA ST., SOUTH MELBOURNE, VICTORIA, AUSTRALIA.



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IN addition to the more usual grades, Carlson regularly produces stainless steel plate and plate products in this wide range of superior analyses in any thickness. Many of these grades are included in our mill inventory; the others can be rolled to your order.

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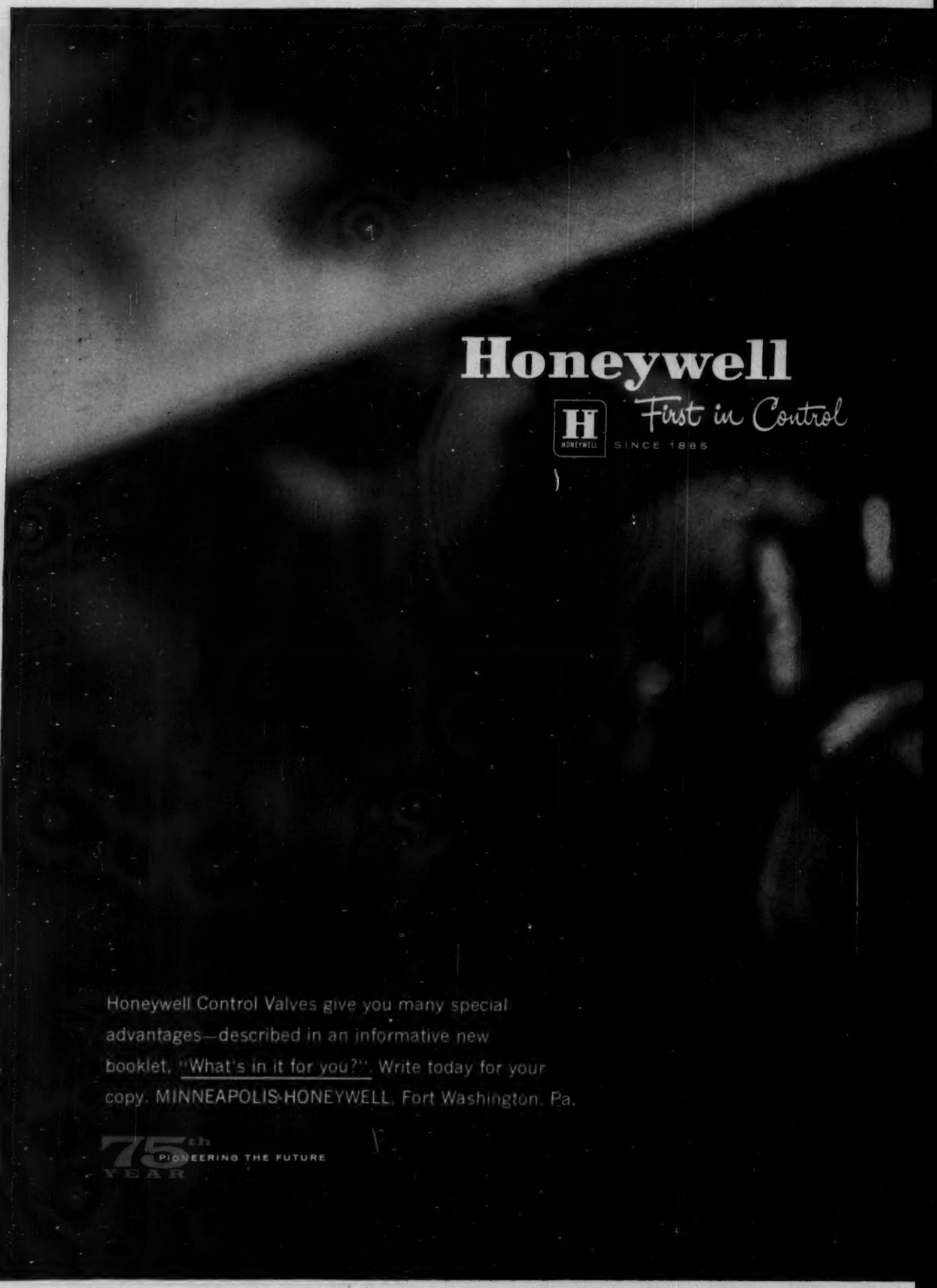
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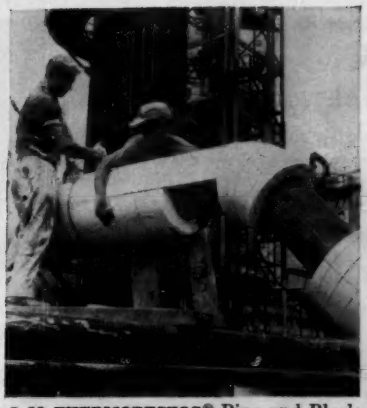
ANOTHER FIRST FROM JOHNS-MANVILLE

Industrial insulations in weatherproof cartons!

All these dollar-saving advantages for pennies more!

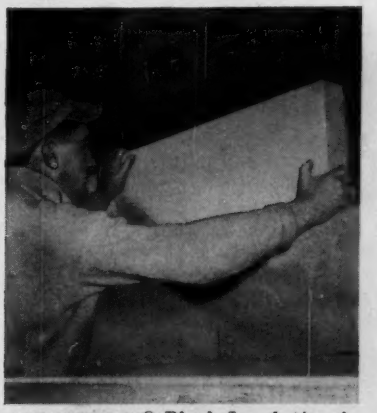
- **NO SHEDS TO BUILD**
- **NO HEAVY TARPAULINS TO HANDLE**
- **WEATHERPROOF FOR A MINIMUM OF 3 MONTHS**
- **SAVE TIME, WORK, MONEY ON THE JOB**



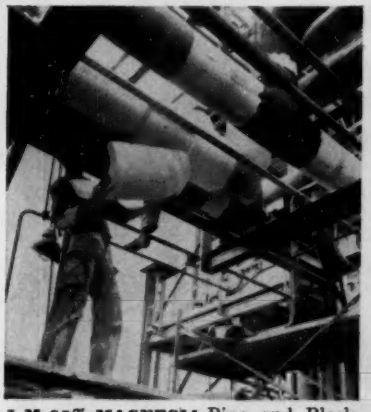
J-M THERMOBESTOS® Pipe and Block Insulation for temperatures to 1200 F., light in weight, top mechanical strength, low *k* factor.

Now, thanks to a new and exclusive Johns-Manville carton, you can do away with on-the-job-site storage problems. Never mind the snow and rain. Just put the cartons on runners or skids—*and forget about weather problems.*

These cartons are proved by actual test to withstand rain and snow up to three full months! No need for sheds, lean-tos, tarpaulins or other protection. For only a slight premium, you save time—work—money. And only Johns-Manville offers you this plus value. Ask your J-M Insulation Contract Unit or your nearest J-M sales office.



J-M SUPEREX® Block Insulation is furnished in flat or curved blocks, and is recommended for equipment operating at temperatures up to 1900 F.



J-M 85% MAGNESIA Pipe and Block Insulation is designed for use up to 600 F. on heated piping and equipment. The standard for decades.

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JOHNS-MANVILLE JM PRODUCTS

AN INSULATION FOR EVERY COMMERCIAL AND INDUSTRIAL USE

FLUIDICS* AT WORK

At Jefferson Chemical Company Inc., this Pfaudler Dryer-Blender discharges directly into drums. Glasteel construction solves corrosion problems and maintains product purity.

No corrosion . . . no contamination with this Glasteel Dryer-Blender

At Jefferson Chemical Company Inc., you'll find this Conical Dryer-Blender used in the manufacture of piperazine salts which go into the preparation of pharmaceutical and veterinary products.

But neither corrosion nor maintaining product purity is a problem, because this Pfaudler Dryer-Blender is constructed of Glasteel—glass inside, steel outside.

It's the glass inside that handles corrosives *without* corrosion. (You can handle all acids, except HF, and most mild alkalies.) And it's the inert glass that *protects* your product; there is no contact with metal. Also, Glasteel is easy to clean thoroughly, since the smooth surface resists build-up, even with sticky substances.

A whole chemical plant. With the Pfaudler Conical Dryer-Blender you can concentrate, impregnate, react, and coat—as well as dry and blend—in a single cycle.

Important savings. Such versatility leads to important savings. You shorten over-all process time, reduce intermediate materials handling, buy less equipment, use less floor space.

Details. For complete specifications and operating data, ask for Bulletin 963. Or inquire about our Test Center program for product evaluation studies.

The new look in reactors

The different silhouette and light-blue exterior, which we can't show you here, tell you that this Pfaudler "RA" Series Reactor is *new*.

For example, start with the mirror image top head. Here you have a symmetrical pattern formed by an equal number of nozzles on each half of the top head. Result? You need less headroom, time and pipe to hook up an "RA" reactor than with other types. Also, you can feed two side-by-side reactors from a single tee.

At the top there is no drive tripod, either. And you choose from two new, very quiet drives—the TW for power requirements to 15 H.P. and the BH for power to 60 H.P. and higher.

At the bottom you'll find the offset outlet nozzle in the direct sweep path of the agitator and in line with the top head manhole.

Inside, of course, it's Glasteel 59 with its resistance to all acids (except HF) to 350° F. and even 450° F., depending on concentration. You can also use this Glasteel with most alkalies at moderate temperatures. Thermal shock resistance is excellent, being 30% over that of the "old" Pfaudler "R" Series. And because Glasteel resists build-up on its surface, you have high heat transfer, increased product yield, fewer shutdowns for cleaning, and long service life.

Two-week delivery (from receipt of your order) on 500, 750, 1000 and 2000 gallon vessels. Standard sizes through 4000 gallons. New Bulletin 988 provides complete specifications. Write for it.

Now, a tantalum heater as large as 124 square feet

Here you see a tantalum bayonet heater believed to be the largest ever produced. It was fabricated by Pfaudler. A special "vacuum purge" welding unit was employed to eliminate the inherent difficulties in welding this metal in the presence of atmospheric gases.

This heater is made up of 52 tantalum tubes, 1½" O.D., and 72" long. This adds up to 124 square feet of heat transfer area. Very efficient heat transfer, too, since the 100% corrosion resistance of tantalum (in those applications where recommended) means there's no fouling factor. Also, the high tensile strength and no need for corrosion allowance make possible thin wall construction.

As you might expect, this heater is a custom unit, and it's being assembled into a custom-made Glasteel reactor. In fact, most of the quite extensive line of equipment we make from the refractory metals is to custom specifications.

What we offer for your consideration is the know-how in fabricating *tantalum*, *titanium* and *zirconium* into a broad range of items—vessels, heat exchangers, bayonet heaters, columns, burners, accessories, baffles—just about anything you might need.

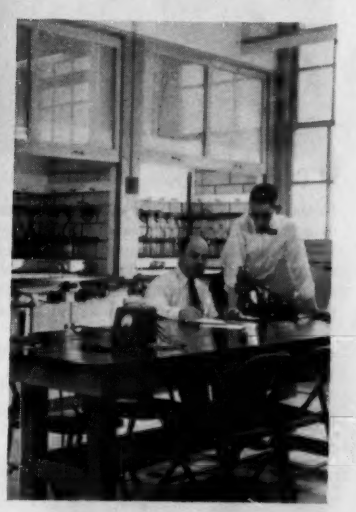
For particulars, write for our Bulletin 978. Or outline in general detail your specific equipment requirements.

Test your corrosives FREE in Pfaudler lab

When you're not completely sure (or you'd like to substantiate your own data) on how a corrosive material affects your process equipment, let Pfaudler evaluate it for you.

Our extensive corrosion lab facilities, background and experience will be put on the project. The men assigned to such a task have run thousands of tests and can provide all pertinent facts relating to best material of construction and expected service life.

Run your own tests. If you prefer, we will supply equipment and procedures for running your own



tests. Then you can evaluate results or return materials to us for observation and conclusions.

Full range of materials. Since our line is complete—Glasteel, the refractory metals, stainless steels and various alloys—you can be sure of getting an impartial recommendation. Data on the various materials will be sent on request, as will further details on initiating a test program. Ask for Bulletin No. 981.

Address all inquiries to our Pfaudler Division, Dept. CE-40, Rochester 3, New York.

FLUIDICS AROUND THE WORLD
Pfaudler Permutit is a world-wide company with manufacturing plants in Germany, Great Britain, Canada, Mexico, and Japan, as well as the United States.

*FLUIDICS is the Pfaudler Permutit program that integrates knowledge, equipment and experience in solving problems involving fluids.

PFAUDLER PERMUTIT INC.
Specialists in FLUIDICS . . . the science of fluid processes

RODNEY HUNT

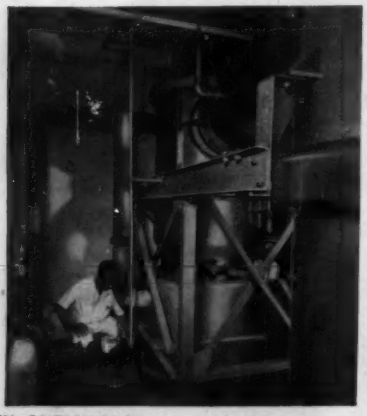
FLUID PROCESSING

RODNEY HUNT MACHINE CO., Process Equipment Division, 10 VALE STREET, ORANGE, MASS.

RODNEY HUNT PROCESSORS APPLICABLE TO WIDE RANGE OF INDUSTRIES AND PRODUCTS

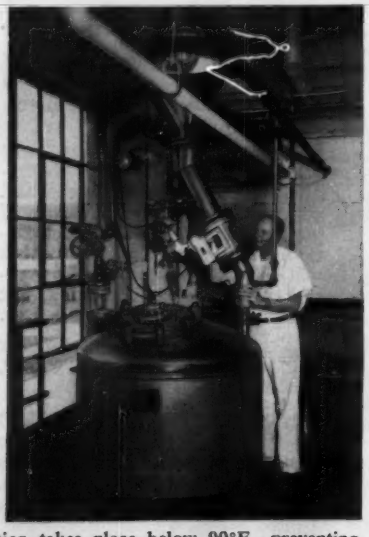
Rodney Hunt Turba-Film® Processors have proven to be extremely versatile not only in the range of industries and products they serve, but also in the different kinds of processes they perform. Processors of chemicals, petroleum, pharmaceuticals, food and many other products have found in the Turba-Film Processor the key to successful production. These mechanically aided thin-film processors assure closely controlled uniformity of product in processes such as: concentration . . . deaeration . . . distillation . . . steam distillation . . . deodorization . . . liqui-solids . . . desolventization . . . and homogenization.

In one pass—continuously and rapidly—the Rodney Hunt Turba-Film Processor provides heat and mass transfer for processing liquids and slurries. Since product quality can be checked continuously, production errors and costly re-runs of reject material are eliminated.

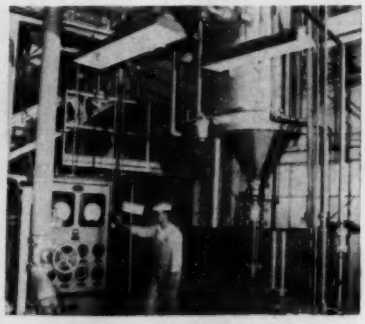


IN CHEMICALS...

In the biological and chemical laboratories of a New Jersey manufacturer, the Turba-Film Processor is extensively used to concentrate products coming from extraction or ion exchange columns. Formerly a batch process, the Turba-Film unit now makes this a continuous operation. In addition to eliminating three vats required by the original process, other operating advantages are reported: product quality is superior; several products are processed consecutively with only brief cleaning periods; evaporation takes place below 90°F., preventing degradation of heat-sensitive antibiotics; capacity is increased, speeding output; and with complete Rodney Hunt instrumentation, the unit requires a minimum of attention and manpower.



The top photo above shows the upper end of the processor, the photo below the discharge end.



IN FOOD...

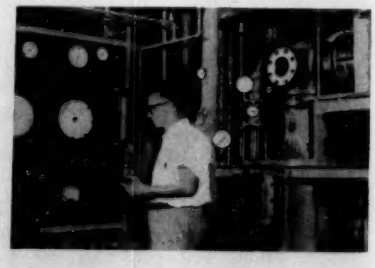
This Turba-Film Processor produces superior quality fruit concentrates at a rate of 5 tons per hour in a packing plant on the West Coast. Operating 24 hours a day during the peak season, the processor maintains an excellent operating record with a minimum of maintenance.

The taste and quality of the concentrates produced are protected from the injurious effects of overheating because of the precisely controlled, short-time exposure of the product in the thermal section. As with other applications, the Turba-Film Processor consistently and automatically retains the essential properties and desired qualities of the product being processed.

On this page are illustrated three typical installations of Rodney Hunt Turba-Film Processors: in *chemicals* . . . in *food* . . . and in *pharmaceuticals*. At the bottom of the page are some of the major American manufacturers who are using the Rodney Hunt Turba-Film Processor to help solve complex processing problems.

IN PHARMACEUTICALS...

A manufacturer of pharmaceuticals encountered product discoloration and loss of product prior to placing a bacteria-killing drug into full production. This problem was solved by replacing conventional evaporator with a Rodney Hunt Turba-Film Processor designed to handle the heat-sensitive product. The Turba-Film Processor helps turn out a uniform top-quality pharmaceutical product.



SOME WELL-KNOWN COMPANIES USING TURBA-FILM PROCESSORS...

Allied Chemical & Dye Corp.
American Cyanamid Company
B. F. Goodrich
Celanese Corporation of America
Colgate-Palmolive Company
Continental Oil Company
Eastman Kodak Company
Esso Standard Oil Company
Firestone Tire & Rubber Company
General Aniline & Film Corp.
General Foods
Goodyear Tire and Rubber Company
Hercules Powder
Hoffman-LaRoche
H. J. Heinz Company
Minnesota Mining & Mfg. Co.
Monsanto Chemical Company
Olin Mathieson Chemical Corp.
Proctor & Gamble
Shell Chemical Corporation
Shell Oil Company
Sohio Petrochemical Company
Standard Brands, Ltd.
Swift & Company
United States Rubber Company
Union Carbide & Carbon Corp.

DEVELOPMENTS . . .

APRIL 18, 1960

Chementator

T. PETER FORBATH

International Minerals & Chemicals claims to have a new route to active (neoprene-grade) magnesia. Process is described only as being "other than conventional carbonation."

U. S. Steel has teamed up with Food Machinery on latter's low-grade coal carbonizing project in Kemmerer, Wyo. (Chementator, Jan. 25, p. 43). A 250-ton/day plant, due on stream this year, will supply coke for FMC's phosphorus furnaces and USS's blast furnaces.

Universal Oil Products has come up with a new catalytic hydro-refining process. Called Lomax, it converts light distillates into gasoline, heavier distillates into high-quality middle distillates, fuels and gasoline.

Navy's Polaris missile is fueled by product from Aerojet-General's new continuous solid-propellant facility at Sacramento, Calif.

Sharp engineering pares fat off process

A telling illustration of what sharp-pencil engineering can do for a well-established process has been provided by Esso Research & Engineering. Last month company unveiled a re-engineered version of its Fluid Coking flowsheet that it claims can be installed and operated at up to ⅓ less cost than the original design introduced in 1953.

Reports Esso, total on-site investment has been reduced from $350/bbl. to $230/bbl. for facilties in the 10,000-bbl./day-capacity class. Operating costs of new version are put at 75% and utility investments at about 35% of previous design. Importantly, these savings are garnered without sacrificing product yield or qualities. And inherent flexibility of process has been retained, Esso declares.

In trimming this fat, Esso engineers left basic coking process essentially intact, concentrated on streamlining flow pattern and mechanical design of equipment. For example, by changing method of handling a recycle stream, they succeeded in eliminating recycle and pump-around exchangers, pumps, much piping and a feed-injection system. By re-designing a scrubber quench pot for increased surge capacity, a separate feed surge drum could be dropped. Too, changes have been made on design and location of a burner, in plant layout, on a waste-gas turbine and on a variety of auxiliary equipment such as aeration taps and transfer lines.

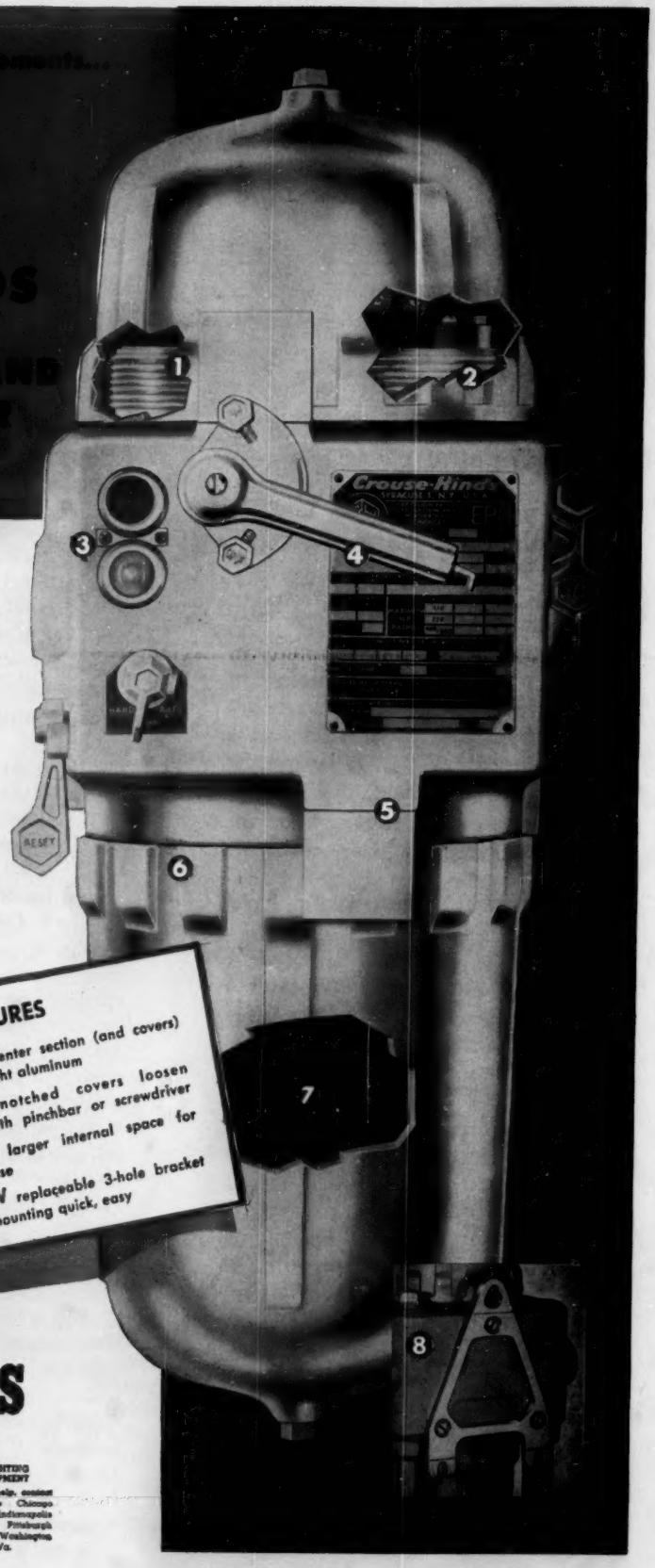
Direct reduction: Add another process

In what is beginning to look like an endless parade, still another direct iron ore reduction process has arrived with an eye towards obsoleting the blast furnace. This one, dubbed Orcarb, is the brainchild of Pittsburgh (Pa.) consultant C. E. Lesher and has been put through its paces in a 150-lb. hr. pilot unit at Indianola, Pa., by Swindell-Dressler.

Key to process: Retorting step which mixes

Now with 8 important improvements... at no increase in price

New EPC CROUSE-HINDS EXPLOSION-PROOF MOTOR STARTER AND CIRCUIT BREAKER



The latest refinement in a long-tested, proved and improved explosion-proof combination Motor Starter & Circuit Breaker, this new Crouse-Hinds Condulet® EPC-M59 brings you tomorrow's convenience, dependability and safety at yesterday's prices.

Designed to conform with the National Electrical Code requirements for Class I, Groups C and D; Class II, Groups E, F and G; and Class III, it provides for built-in breathers and drains . . . built-in push-button stations, selector switch and pilot lights . . . seven taper-tapped conduit entrances . . . starter below breaker for safe, easy maintenance . . . compact design to permit a greater number of controls in any given area.

Now available in 7" and 9" sizes for Sizes 1 and 2 starter combinations. For more detailed information consult your Crouse-Hinds distributor, or any of the offices listed below.

ALL THESE NEW FEATURES

1 **NEW** raintight joints for both top and bottom covers

2 **NEW** shoes and guidance slot for easier interior assembly mounting

3 **NEW** built-in pilot lights available where visual indication desired

4 **NEW** easier-to-lock breaker handle (takes up to 3 padlocks)

5 **NEW** center section (and covers) of lightweight aluminum

6 **NEW** notched covers loosen quickly with pinchbar or screwdriver

7 **NEW** larger internal space for wiring ease

8 **NEW** replaceable 3-hole bracket makes mounting quick, easy

CROUSE HINDS

MAIN OFFICE AND FACTORY: SYRACUSE, NEW YORK

Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.
Crouse-Hinds Instrument Company, Inc., Silver Spring, Maryland

• CONDULET® ELECTRICAL EQUIPMENT (Explosion-Proof and Conventional) • FLOODLIGHTING
• TRAFFIC CONTROL SYSTEMS • AIRPORT LIGHTING and WEATHER MEASURING EQUIPMENT

These products are sold exclusively through electrical distributors. For application engineering help, contact one of the following offices: Atlanta Baton Rouge Birmingham Boston Buffalo Charlotte Chicago Cincinnati Cleveland Corpus Christi Dallas Denver Detroit Houston Indianapolis Kansas City Los Angeles Milwaukee New Orleans New York Omaha Philadelphia Pittsburgh Portland, Ore. St. Louis St. Paul Salt Lake City San Francisco Seattle Tulsa Washington
Resident Representatives: Albany Baltimore Reading, Pa. Richmond, Va.

iron ore and coking coal into pellets. These Orcarb pellets then feed a rotary kiln where ore is 80% reduced. Kiln product goes to a submerged-arc furnace which produces pig iron.

Main advantage claimed for process is a capital investment about half as much as that required by conventional blast furnace steel plant. A 2,000-ton/day Orcarb installation, say S-D, would cost about $25 million; operating costs would run about the same as for blast furnace.

Two other direct reduction routes—Strategic-Udy's and the R-N process—employ similar reducing kilns. Orcarb's differs from Strategic's in its high degree of pre-reduction before the electric furnace. This cuts furnace power requirements to less than 1,000 kwh./ton iron. And it differs from R-N in eliminating R-N's briquetting step.

To start Orcarb, iron ore fines are preheated in kiln at 1,000–1,200 F. Ore then flows to rotary retort along with coking coal. At 600–700 F. coal becomes plastic and mixes with ore. Material pelletizes and pellets harden at 850–950 F. before discharging. Pellets then feed to reducing kiln which operates at 1,800–2,000 F. with 2-hr. retention time. Fuel for heating kiln comes from CO released in reduction reaction. The 80% reduced pellets are converted to pig iron in electric furnace.

Phos acid via HCl, solvent extraction

An uncommon reagent—hydrochloric acid—and an uncommon processing stage—liquid-liquid solvent extraction—highlight a new phosphoric acid process now winning its first commercial-scale jobs. Developed by Israel Mining Industries (Tel Aviv) and in pilot operation there, flowsheet has been licensed to Toyo Soda Manufacturers Co. for commercialization in a 7-ton/plant in Tokyo. A number of other Japanese firms reportedly will also apply for process rights shortly. And Brooklyn Poly's Don Othmer, who played a key role in bringing the Israelis and Japanese together, tells *CE* that the IMI route is beginning to elicit interest from India and the U. S.

Chief advantage of using HCl rather than, say, sulfuric acid in making phos acid stems from the high-concentration material produced as a result. IMI process turns out 58% P_2O_5 material compared to 42% P_2O_5 product of conventional wet-process flowsheets, declares company spokesman. Moreover, product is said to be much purer than conventional wet-process acid. IMI product analyses 0.09% Zn, 0.03% Fe, 0.009% Cu, 0.007% Cr, 0.005% As. 0.004% V. Still another, if more specialized feature: Process provides means of putting excess HCl to work, offers route to H_3PO_4 in areas where H_2SO_4 is costly.

Though these advantages have been recognized for some time, HCl hasn't been able to score commercially in H_3PO_4 making before this because the calcium chloride and phos acid formed in the process are both soluble in aqueous media, thus difficult to separate. IMI whips this problem by using an organic solvent to extract H_3PO_4 from $CaCl_2$.

In process, phosphate rock is dissolved in aqueous HCl. Undissolved tailings go to waste, solution passes through a series of mixer-settlers where it contacts organic solvent (e.g., *n*-butyl or *i*-amyl alcohol). The H_3PO_4 enters solvent phase; $CaCl_2$ and HCl remain in aqueous phase. Water wash and distillation yield phos acid product.

Computer networks for future plants

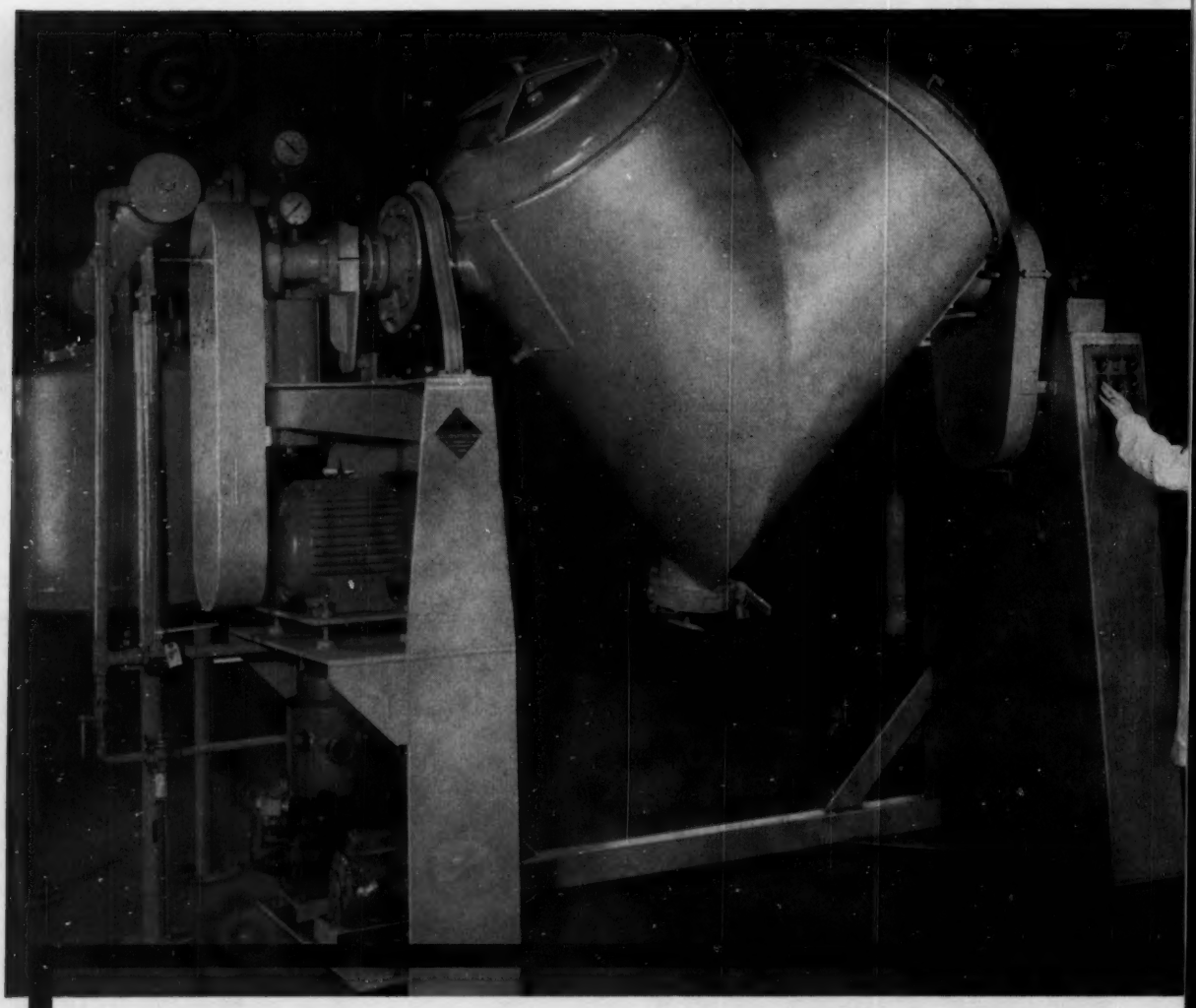
Announcements from three computer manufacturers last month have focused chemical industry attention on an advanced concept. It is the coordinating of widespread industrial operations by using long-distance data transmission to and from centrally located computer.

Radio Corp. of America and International Business Machines report having developed data-transmission systems that can send and receive digital data between peripheral facilities and a central data-processing computer via telephone (100–150 characters/sec.) or teletype (5–10 characters/sec.). Control Data Corp. has gone one step further, has come up with a system that would have computers on both receiving and sending ends of the line. Smaller computers in network's "satellite" facilities would call on large central computer for greater speed or capacity.

Firms like Socony-Mobil, Du Pont, Celanese and B. F. Goodrich have made use of data-transmission networks for some years now. But they've been forced to use expensive leased lines with unsatisfactorily slow-speed transmission.

Newly available systems would work this way: A chemical firm, with geographically scattered operations of varied nature (e.g., raw materials allocation, process control, account-

(Continued on page 84)



Now for the first time you can combine vacuum-drying and liquid-solids blending in a single packaged unit — the new P-K Solids-Processor. This latest P-K "Twin-Shell" development dry blends solids, disperses liquids, granulates and dries in simple sequence.

DRY BLENDING — Solids are tumbled to give gentle precision blending. This may be done under vacuum or atmospheric conditions, in inert or sterilizing gas, with heat in jacket up to 200° F., or with cooling water circulated through jacket. When needed, intensive blending breaks up agglomerates or gives uniform dispersion of pigments.

LIQUID DISPERSION, GRANULATING — Minute or large percentages of liquid are uniformly dispersed into solids. Dispersion can be sufficiently intimate to provide lump-free production. Or it can be regulated to produce granulations of controlled size. As in dry blending, these steps can be conducted under vacuum or atmospheric conditions, in inert or sterilizing gas, with heat in jacket up to 200° F., or with cooling water circulated through jacket.

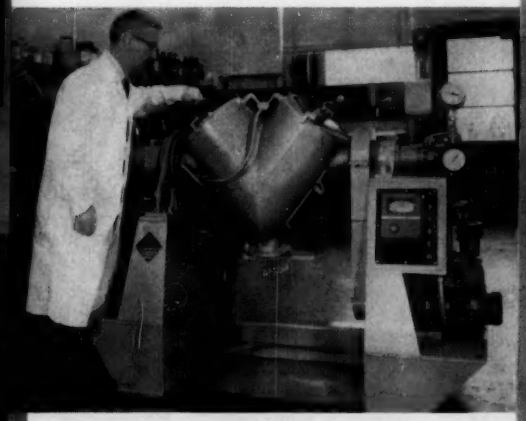
DRYING — The new packaged system allows vacuum drying of heat sensitive materials with continuous turn-over and re-blending of solids. During drying, small balls with an insulating crust that inhibits complete drying tend to form. A separately actuated agitator breaks these up, permitting drying to a finished fine powder. In final stages of drying, direct hot air or gas can be introduced to reduce liquid content quickly to a fraction of a percent.

All P-K Solids-Processor systems are completely packaged. Available in standardized models with charge capacities from one to fifty cu. ft.

Revolutionary!
P-K Solids-Processor*
adds vacuum drying to liquid-solids blending...

Pre-test model available

We invite you to bring or send your materials to the P-K Pre-test Laboratory in East Stroudsburg. A one cu. ft. model of the new Solids-Processor is available for pre-testing . . . to demonstrate things impossible to see without pilot study . . . to work out subtle variables in blending, granulating and drying . . . to indicate accurately scale-up results and operational procedures . . . to predict savings in materials, labor and equipment investment.



Performs these operations:

1. Precision gentle blending
2. Intensive blending
3. Liquid dispersion in solids
4. Liquid-solids blending under vacuum
5. Granulation of solids
6. Dry blending under vacuum
7. Vacuum drying or cooling of solids
8. Heat sterilization of solids
9. Coating of solids
10. Chemical reaction under heat and vacuum
11. Direct gas drying

It's best if you can come yourself for pre-testing. You'll work with well-qualified engineers who have made thousands of resultful pre-tests for processors. They often suggest and produce unexpected product variations. Your guidance as to what is best for your product or process will be helpful. All you need is enough material for three separate one cu. ft. trial runs.

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*patented and patents pending

ing, product inventory and distribution) might find that, although company-wide it has enough work to justify a computer, it couldn't pay for a computer in any one location. Thus, each facility would relay data to a centrally located computer via phone or telegraph lines and receive a computed solution the same way.

American Tel & Tel has chipped in to help make the economics of long-line transmission more attractive. Its Data-Phone service, introduced about two years ago, offered longline data processing only through leased private wires. Now AT&T is offering the same service in toll calls—either at person-to-person or station-to-station rates—through its regular phone network. This means that equipment now offered by computer makers can "dial up" central computer.

Whip air pollution, make fertilizer

Remove air-polluting sulfur compounds from flue gas and produce an eminently marketable byproduct in the bargain. That's the claim Chemical Construction (Great Britain) Ltd. is making for a new process that's now up for licensing.

Process: Inject ammonia gas into flue gas, so tie-up and remove over 90% of its sulfur content in ammonia compounds. Byproduct: Low-cost, fertilizer-grade ammonium sulfate, salable at nearly $20/ton less than conventionally produced material. Process reportedly has been proved out in a pilot plant handling 2.5 million cu.ft./hr. flue gas. And now Chemico is negotiating with England's Central Electricity Generating Board to build an experimental unit at one of Board's power stations that burns high-sulfur coal, so must contend with high-sulfur flue gas.

Ammonia injection as a sulfur-removal technique is not entirely new. About two years ago British Petroleum tried the idea at its Marchwood power station. But company ran into various problems and process temporarily fell into disrepute. Variations on the theme, however, are in current practice. For example, Consolidated Smelting & Refining (Trail, British Columbia) absorbs sulfur-laden gas in aqueous ammonia to produce ammonium bisulfite from which 100% SO_2 can be regenerated.

In Chemico's process, sulfur-heavy flue gas (e.g., from power-station boiler) passes through a waste-heat boiler, then mixes with ammonia gas stream. Reaction between ammonia and sulfur oxides in gas produce "fog" of ammonium sulfur salts such as sulfite, bisulfite, sulfate and thiosulfate which are removed in an electrostatic precipitator. Cleaned flue gas is vented, ammonium sulfur salts are dissolved in water, and fly ash is removed in rotary vacuum filter. An oxidation step converts sulfites in solution to sulfate; an evaporation-crystallization step produces ammonium sulfate slurry.

New fluorocarbon resin eyes market

Chalk up another entry in today's expanding fluorocarbon resin field. Pennsalt Chemicals bows in with polyvinylidene fluoride, a material which reportedly comes close to combining virtues of fluorocarbons with the fabricability of, say, vinyls. Resin currently is in pilot plant production at Wyndmoor, Pa., will go into commercial-scale production once market studies now underway are completed.

Pennsalt believes the new resin, called RC-2525, will find a niche—in cost, versatility and properties—somewhere between polyolefins and perfluorocarbons such as Du Pont's Teflon 100. Chemical resistance is said to be not quite as good as fully fluorinated materials. Similarly, upper service temperature limit —about 320 F.—falls a little short of perfluorocarbon standards. On the other hand, Pennsalt's product is suitable for a wide variety of fabrication; it can end up as packaging film, sheet, wire coating, molded products, laminates or spray coating. Moreover, the material is resistant to gamma radiation, exhibits good stability and a sharp melting point.

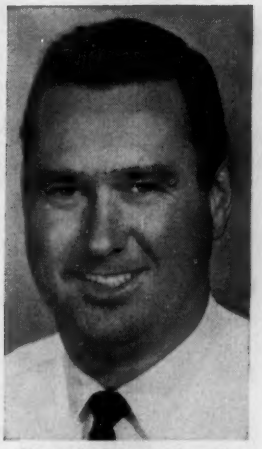
Tomorrow's Technology

Today's embryonic developments which have special significance for chemical engineers

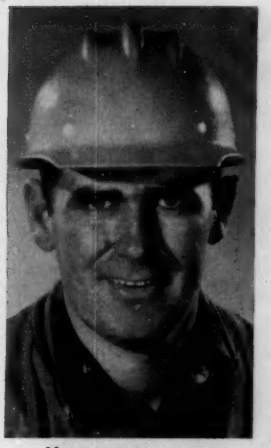
Oil shale: Source of chemicals?

Oil shale as a source of chemicals as well as fuel? It's technically and economically feasible, declares Russell Cameron of consulting firm Cameron & Jones (Denver). Pointing to European work in this field to back his contention, Cameron told a meeting of AIChE's New York section last month that U. S.'s vast deposit of oil shale could be tapped quite competitively for materials such as ethylene, ethane, methane, benzene, naphthalene, sulfur,

He's a nucleonics engineer



He works in a textile mill



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PHYSICAL AND CHEMICAL PROPERTIES

Appearance	colorless to white, slightly moist crystals
Formula	$Al(NO_3)_3 \cdot 9H_2O$
Molecular Weight	375.14
Density (approx.)	13.2 grams per cubic inch

Melts in its water of crystallization at 73°C., and decomposes at 135°C. The aqueous solution is weakly acidic because of hydrolysis. Soluble in water, alcohol, acetone, nitric acid and carbon disulfide.

Typical Analysis:

Assay ($Al(NO_3)_3 \cdot 9H_2O$)	99.75%
Insoluble in water	0.005%
Iron (Fe)	0.006%
Heavy Metals (as Pb)	0.001%
Free Nitric (HNO_3)	0.20%

Screen Size:

On 12 mesh	8%
On 20 mesh	48%
Thru 20 mesh	44%

Here are suggested uses for B&A Aluminum Nitrate. You may have additional ones in mind:

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Textiles . . . in the dyeing of acetate rayon
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A reagent grade of this product is also available for use in electronic tube production, in the manufacture of fluorescent lamps, and for other uses requiring an aluminum nitrate of particularly high purity. This reagent is packaged in the same sizes as the technical materials, which are shipped in 100-pound and 375-pound drums with polyethylene bag liners.

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ammonia, ammonium sulfate, LPG. Reasons: Low cost of raw material, ease of processing it.

Various European countries, which were forced to build oil-shale-based fuel industries under wartime pressures, are now starting to turn their equipment to the job of making chemicals. For example, Swedish Oil Shale Co. is currently running a former fuel plant to process 10,000 tons/day shale into 37,500 tons/yr. sulfur, 24,000 tons/yr. ammonium sulfate, 1,000 tons/yr. ammonia, 12,000 tons/yr. LPG, 66,000 tons/yr. quicklime and "several thousands of tons/yr." sulfur dioxide. Paying about $4.50/ton for organics extracted from shale (kerogen), the Swedes are producing these chemicals at competitive prices.

Granting Europeans the advantage of having had commercial-scale shale retorts in existence when they went into the chemical business, Cameron believes U. S. firms could net equally attractive results even though they'd be forced to start from scratch. Shale-derived organic raw material would cost about $10/ton in U. S., Cameron figures. This compares favorably with prices of alternate organics such as $12/ton for fuel oil, $20/ton for crude petroleum, $30/ton for petroleum naphtha, $10/ton for natural gas.

Moreover, shale's kerogen is very amenable to processing, Cameron points out. Kerogen gasifies at 800 F. giving off methane, ethane, propane, unsaturated oils and waxes. At 1,200 F. it gives high yields of ethylene, benzene, naphthalene and tars. Kerogen reacts with steam at 1,000 F. to produce synthesis gas; at 1,200 F. and 2,000 psi. kerogen and hydrogen react to produce methane and ethane.

As an example of what might be done in U. S., Cameron has worked out a flowsheet for a 10,000-ton/day shale processing plant. It would produce 625 million lb./yr. ethylene, 20,000 tons/yr. ammonia and 2 million gal./yr. benzene, would cost $73 million, turn out ethylene for about 2¢/lb.

Goal: Trim overdesign safety factor

Required overdesign of pressure vessels—commendable in its concern for safety, frustrating in its costliness—may be in for some much -desired trimming. That, at least, is a prime goal of the 3-yr., $120,000 pressure-vessel research program, sponsored by Atomic Energy Commission and Welding Research Council, now under way at Southwest Research Institute, Lehigh University, University of Illinois, Babcock & Wilcox Research Center and Ecole Polytechnique (Montreal).

Present ASME Boiler Code requires that unfired pressure vessels be designed with maximum allowable working membrane stresses of only ¼ the ultimate strength of materials used in their fabrication. This means that, though materials with ultimate strength upwards of 130,000 psi. are available, pressure vessels rarely can be built with an allowable working stress in excess of 20,000 psi.

In many observers' views, this safety factor is "a fairly accurate measure of the ignorance attending pressure vessel fabrication. Not enough is known about the mechanisms involved in plastic fatigue in large-size vessels, nor is there a really rational method of stress analysis for predicting magnitudes of significant stresses in such vessels."

Research and development briefs

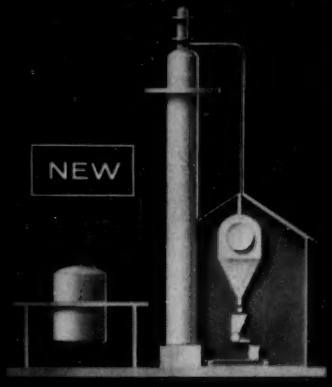
Ceramics can be made ductile by applying high voltage (5–10,000 v.) d.c. across them, claims Materials Research Corp. (Yonkers, N. Y.). Company contends brittleness of materials such as magnesia and alumina is not natural state; it's due to ultra-thin (1–3 atoms thick) surface layer of contaminants. High voltage ionizes contaminant layer, so permits ceramics to be worked with ease of metals.

New electrical separation technique has been developed by Princeton University researcher Herbert Pohl. Unlike usual electrostatic processes, Pohl's device functions on uncharged particles. Non-uniform electrical field separates particles on basis of their different dielectric constants. A 1-gram/min. unit, requiring about 0.001 w. of power, has been used to separate zircon from rutile-zircon sands, sodium dichromate from titanium dioxide, powders suspended in benzene.

Is photopolymerization key to new, dry chemical-less photographic process? That's what Air Force wants to find out with its 18-mo., $70,800 contract awarded to Technical Operations, Inc. (Burlington, Mass.). Process involves exposing film coated with monomer (e.g., vinyl) to ultraviolet. U-v energy is sufficient to polymerize monomer. Polymer formed makes pattern on film that scatters visible light, so represents picture taken.

For more on DEVELOPMENTS.....88

10 SD plants in 5 countries will produce 130,000,000 lbs. of maleic anhydride — more than half the world's capacity



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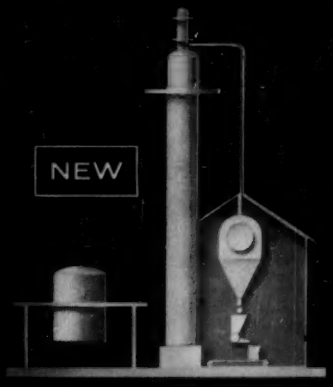
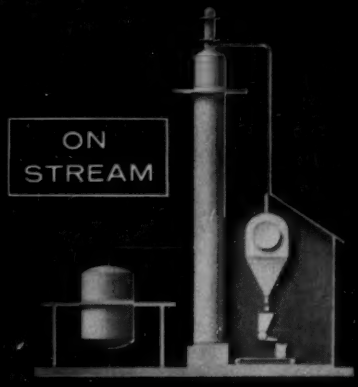


EUROPEAN PLANT



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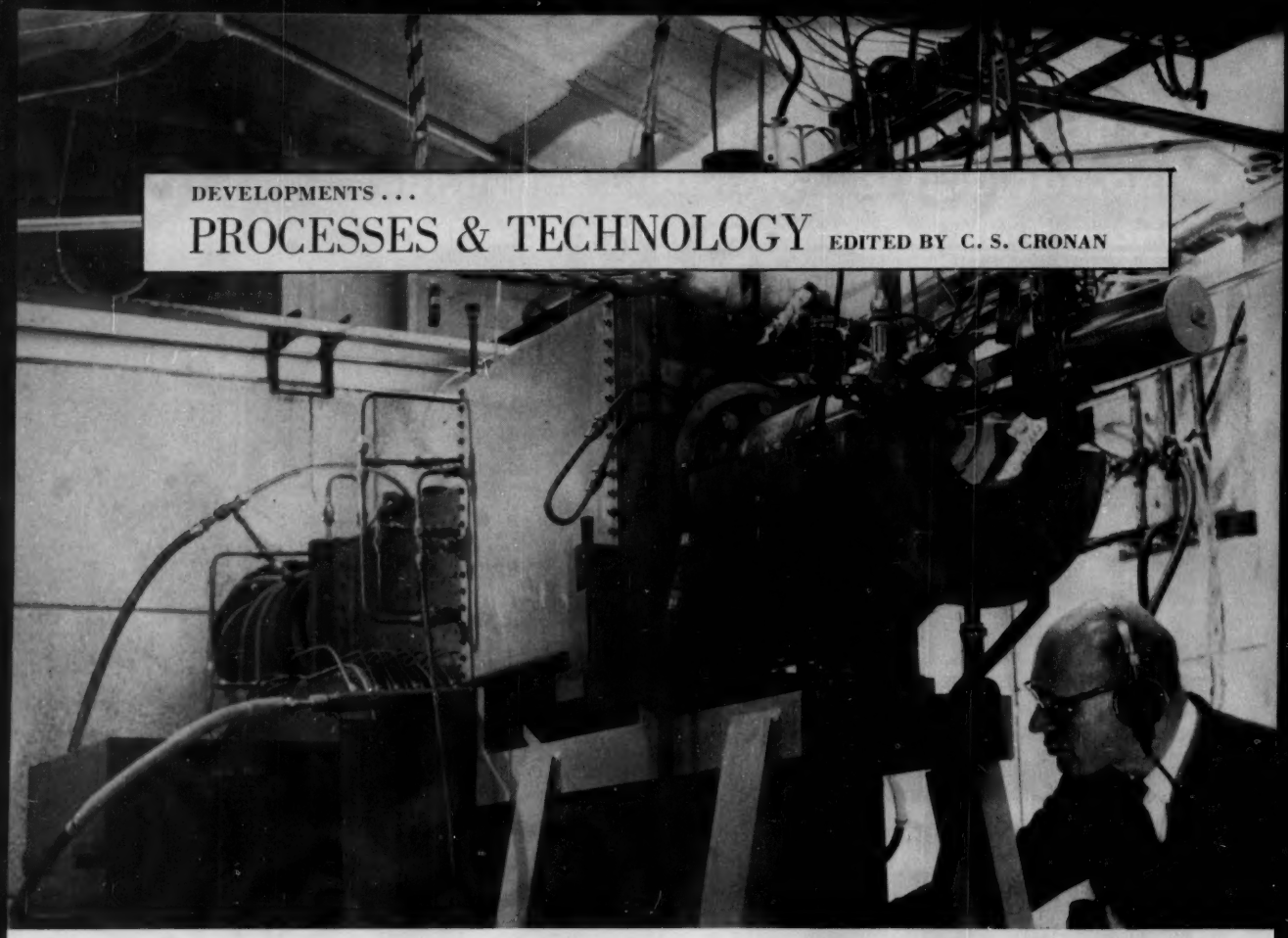


Exotic Devices for Future Power Needs

Thermoelectrics, magnetohydrodynamics and thermionics promise means of more efficient, versatile energy conversion.

Late last month Westinghouse Electric Corp. unveiled at its Pittsburgh, Pa., labs the unfamiliar-looking device pictured above. It's an electrical generator capable of producing up to 10 kw. of power by passing a hot, ionized gas stream through a magnetic field. And it represents the latest breakthrough in what's fast becoming one of today's liveliest areas of engineering research—electrical-power generation by strikingly unconventional techniques.

Magnetohydrodynamics, the principle harnessed in Westinghouse's machine, is just one of the new techniques that's come in for a breathtaking burst of activity lately. Within the last few months, thermoelectric and thermionic power-generating concepts, too, have been brought under concerted and financially generous development programs by an impressive array of firms.

Behind this rush of work stand the needs to (1) find more effective ways of exploiting the world's steadily diminishing energy supply and (2) develop small, reliable, long-life power packs for man's adventure into outer space. For these techniques hold highly promising keys to the means of more directly and efficiently converting stored energy into electrical power.

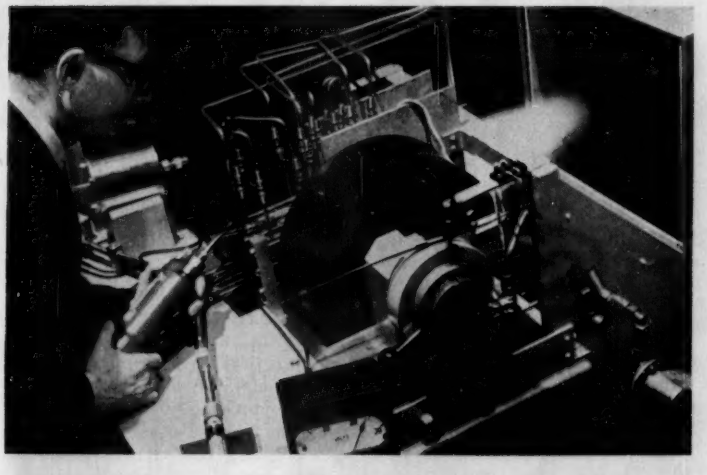
Both from the point of view of the challenges raised in their development and the utility promised by their eventual commercial application, these techniques have captured the interest and efforts of chemical engineers. For that reason, *CE* here presents a survey of the principles, potentials and problems of thermoelectrics, magnetohydrodynamics and thermionics.

Thermoelectricity:

Straight From Thermal to Electrical Energy

Of the three techniques, thermoelectrics, which offers a means of converting heat directly into electricity, probably has been the subject of the most widespread development to date. A sampling of firms prominently at work on thermoelectric generators includes Westinghouse, International Telephone, General Electric, Minnesota Mining, Martin, Bell Telephone, Carrier and General Dynamics. Too, the Russians and a number of English firms have made notable advances in the field. And the bulk of the Air Force's Project SNAP (Systems for Nuclear Auxiliary Power) space-vehicle power-packs center on thermoelectric devices.

These devices are based on the long-known principle used in temperature-recording thermocouples. When heat is applied to one end of certain materials, that material's negative electrons migrate to the cooler end while its positive ions remain fixed. Result: An electrical potential difference across the material which will produce a d.c. current flow through an external load. Materials that exhibit this thermoelectric property range from the relatively commonplace to the exotic, do so in varying degrees at different temperatures and include zinc antimony, lead telluride, bismuth telluride, germanium telluride and samarium sulfide among the most applicable. They are fabricated, either singly or in combination, into series-hooked thermocouples so that their voltages add and are tied to a heat source.



Magnetohydrodynamics:

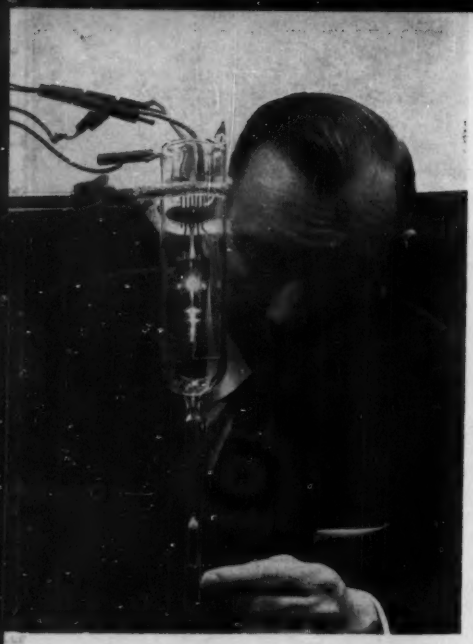
Ionized Fluid Flows Through Magnetic Field

Though very likely still a tongue tripper for most engineers, magnetohydrodynamics (MHD) is no longer an entirely unfamiliar word. In less than a half year at least three electrical-power generators based on this principle have made top technical news.

General Electric, late last year, disclosed that it had built a lab-scale MHD device capable of producing 1,000 w. of power in 5-sec. bursts. Shortly thereafter, Avco Corp. announced that, with the backing of ten electric utilities, it had developed an 11,000-w. generator and was planning a 100,000-w. version for the not-too-distant future. Now Westinghouse has unveiled its experimental MHD machine of 10,000-w. capacity and extended-time (over 4-min.) operation.

Though differing in details, these three machines convert thermal energy to mechanical energy to electrical energy via a concept first noted by Michael Faraday over 130 years ago. A hot, ionized fluid is passed at high speed through a magnetic field. This field, which is placed at right angles to fluid's flow, deflects the free electrons in the stream. They then flow through electrodes inserted in the fluid to an externally connected load, thus generate power. (If the magnetic field is d.c., d.c. power is generated; if it's a.c., a.c. power is made.)

In GE's machine, the working fluid is a 5,000 F. ionized air plasma. Avco uses an ionized argon plasma at temperatures in excess of 4,000 F. Westinghouse, seeking more readily and economically available fluids, has succeeded in harnessing the combustion products of furnace oil and oxygen to the MHD power job. To get the needed ionized condition, the company "seeds" the 4,600 F. gas stream with easily ionized potassium soap. Too, Westinghouse has studied hydrogen-oxygen combustion gases seeded with potassium.



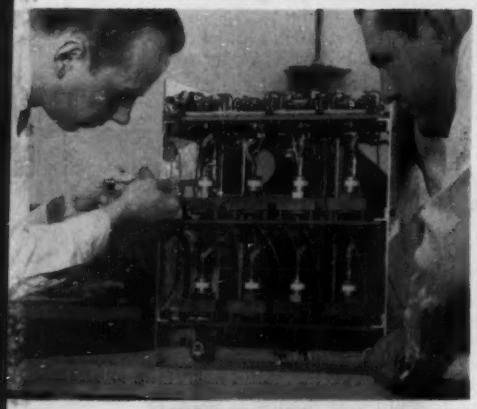
Thermionics:

Electrons Boil-Off Cathode Into a Vacuum

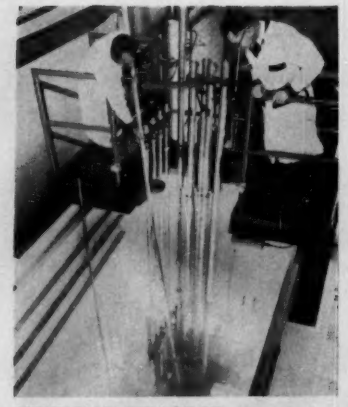
Like thermoelectrics, thermionics is a technique for directly converting heat into electricity. And it accomplishes this feat by very much the same basic principle as well.

By heating certain materials, that material's electrons are put into motion while its positive ions remain unmoved. But, unlike thermoelectrics, the electrons in a thermionic device are made to "boil off" the surface of their parent material—the cathode—and migrate across a vacuum to another surface—the anode. But, in passing through the vacuum, the electrons run into the problem of mutually repelling each other and impeding their flow. To overcome this problem (called space charge), positively charged ions (e.g., cesium) in sufficient numbers to neutralize the electron charge are introduced to the vacuum. Then by hooking a load between the cathode and anode, d.c. power is generated.

Thermionic principle, though long-appreciated and used in electronic vacuum tubes, is, of the three concepts, in the earliest stage of development for use in power generation.



INVERTER makes a.c. from d.c. produced by new power generators.



NUCLEAR REACTOR rates as top source of needed high temperatures.

Problems and Potentials Rated as Great

Tieing these three techniques together even more strongly than any underlying chemical and physical similarities are the advantages they offer over conventional power-generating concepts and the problems that must be solved before these advantages can be exploited commercially.

Chief among the advantages: High energy-conversion efficiencies. Declare researchers, MHD power stations can be built with over-all thermal efficiencies better than 60% even at the present state of the art. This compares with 40-45% efficiencies of the most modern conventional power plants now in operation. Thermoelectric and thermionic generators presently operate at only 5-10% efficiency but, by 1965, units of 30% efficiency are predicted and researchers are confident that continued development will raise that figure over 40% before the end of the decade.

Moreover, these devices operate without moving parts. And this means low-maintenance, high-reliability power installations. Too, they operate virtually noiselessly and can be built in lightweight, compact power packages.

These features indicate a wide variety of applications for the three techniques. Already they offer the most satisfactory means of putting electrical power into outer space. Too, their noiselessness and compactness make them ideal for military and specialized uses as portable power sources for isolated outposts and in shipboard installations. But, undoubtedly, these techniques, thanks to their highly efficient operation, will eventually take over large-scale industrial power generating jobs from conventional devices. As a starter they may be used as "topping" plants to improve operating efficiencies of present-day power stations. And they may be used to provide electrical power for special industrial applications such as in electrochemical operations and for cathodic protection of oil well and pipeline equipment.

But before these potentials will be realized, researchers are quick to point out, a number of major problems will have to be overcome. In usual operation, these techniques produce d.c. power, thus economical means of converting d.c. to a.c. must be developed. And high temperatures (frequently over 5,000 F.) are required, thus economical high-temperature sources and high-temperature-resistant materials must be developed. Tough as these problems are, their solutions are already well in the making.

For example, new semiconductor inverters such as trinistor rectifiers seem to offer a very workable answer to the d.c.-a.c. question. These rectifiers, consisting of silicon wafers, have been operated to about 60 kw.,

these platinum catalysts

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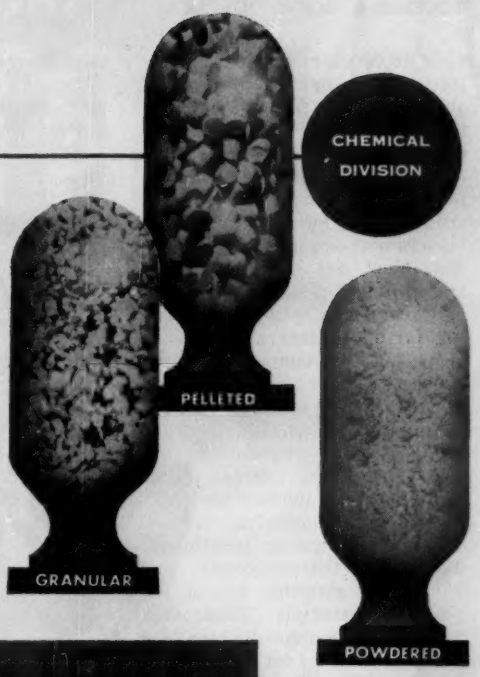

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NEWARK, N. J.

with 10,000 kw. and eventually 100,000 kw. operation foreseeable. And they can be built in tiny units and in almost any geometric form. But most important, their one major drawback — high cost — is rapidly crumbling. Whereas trinistor inverters cost around $150/kw. today, they are expected to be priced under $45/kw. by 1970. This compares with about $70/kw. for motor-generating sets.

As for high-temperature heat sources, nuclear energy probably holds the most immediately promising prospects. For example, SNAP power-packs use both energy of isotopic decay and energy of nuclear fission to activate thermoelectric devices. A more intriguing possibility: Fabricate thermoelectric and thermionic elements out of fissionable materials. Thus, electron source becomes its own heat source and the heat of fission is converted directly into electricity without going through the usual step of first converting to mechanical energy.

With the development of new metals, intermetallics and ceramics, the answers to the materials' problem are also rapidly beginning to take shape. As they do, thermoelectricity, thermionics and magnetohydrodynamics begin more and more to appear as the power-generating techniques of the future.

Portable, High-Voltage Atomic Generator Claimed

A portable thermoelectric generator delivering the impressively hefty output of 24,000 v. has been developed by Soviet researchers, it's reliably reported. Unit's principle of operation: Conversion of the heat of beta-ray radiation directly into electricity.

Though no real technical details are yet available, the high-voltage atomic generator is known to consist of a small bulb made by welding two glass cylinders around the container of the beta-ray source. Outside wall of this container is made of nickel, inside wall of aluminum. Beta-ray source itself consists of a seamless tube that has been coated with an undisclosed radioactive compound.

ELECTRON BEAM generator hits polyethylene film with 2 million v.

Irradiated Plastic Film Offers Unique Properties

What may be the first truly commercial irradiated plastic film was unveiled last month by W. R. Grace. It's irradiated polyethylene. And, according to company spokesmen, it offers, among other attractive features, an exceptionally high heat shrinkability—a property never before available in polyethylene.

Grace's Cryovac Div., after some three years of research, developed the technique for producing the film at its Simpsonville, S. C., plant where the material is now to be produced on a commercial scale. Process involves the use of a General Electric electron-beam generator housed in a 3-ft.-deep vault surrounded by 5-ft.-thick concrete insulation.

Conventional polyethylene film —high density, low density or a mixture of the two depending on final product properties desired —is first extruded into tape. Then it's passed under the eye of the electron-beam generator and subjected to electron bombardment up to 2 mev.

Result: Unstabilized polyethylene molecules cross link. This increases strength of film by more than 500%, claims Grace, and makes it possible to stretch the material more than 200% in both directions.

After stretching, film is wound on rolls and slit to size for many packaging applications.

Ability to stretch film, due to irradiation, gives the material its high heat shrinkability. When exposed to temperatures around 180 F., film almost immediately shrinks by 20%.

And this property makes possible packaging techniques that use "shrink energy" to do much of the wrapping and sealing of the package itself. Through hot-air shrink techniques, for example, film can be made to shrink itself around various produce, poultry, meats, etc.

In addition to this property, the irradiated film is said to be 6-8 times stronger than conventional polyethylene film, have exceptional clarity and gloss. Too, its price is competitive with other films at 3¢/1,000 sq. in.

Bids to Reclassify Cellulosic Fibers Fail

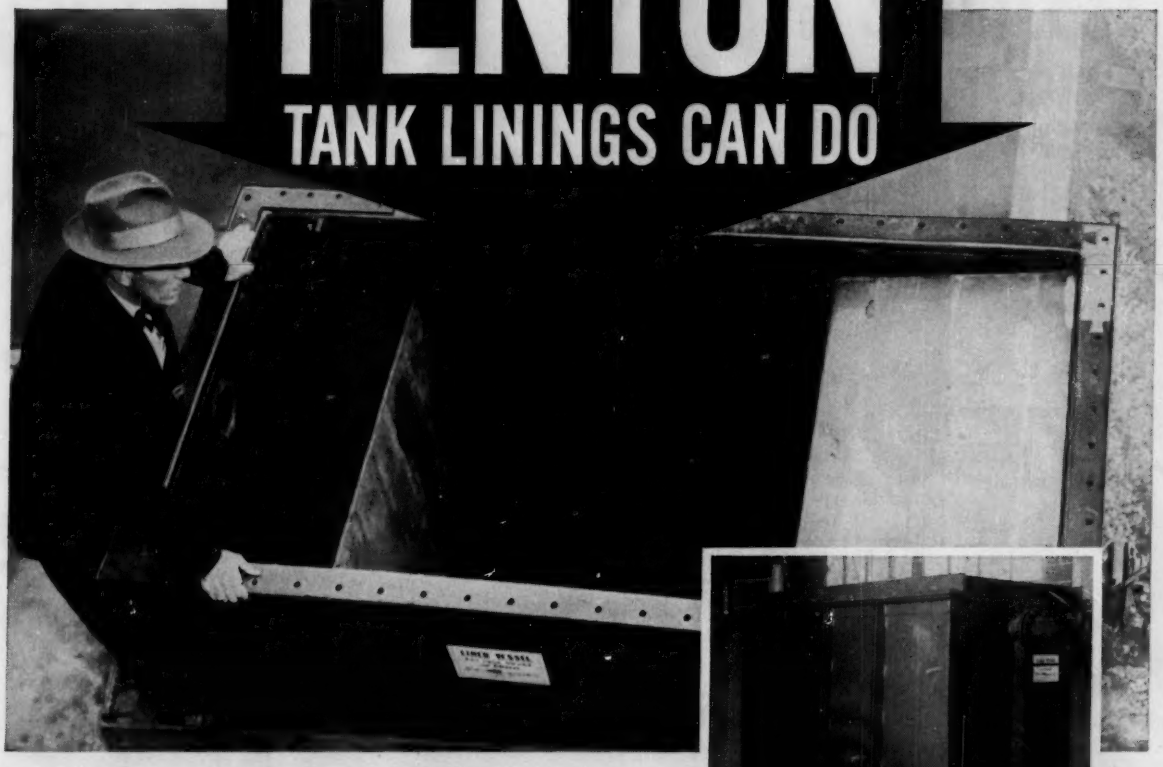
Two simultaneous and, hopefully, ground-breaking attempts to get the Federal Trade Commission to reclassify what is and what isn't a rayon fiber under its Textile Fiber Products Identification Act have failed.

Both Courtaulds (Ala.) Inc. and Hartford Fibres Co. had placed motions before United States District Court (District of Columbia) Judge Luther W. Youngstahl in which they asked to be allowed to continue marketing their new cross-linked cellulosic fibers under generic names other than rayon after FTC's new act became effective on March 3 (*Chementator*, Feb. 22, p. 53). Last month both motions were denied.

Courtaulds sought to call its Corval and Topel fibers licron. Hartford wanted to tag its Zantrel as a polynosic fiber. Basis for their bids: Claims that these fibers have properties radically different from those commonly known as rayons.

Processes & Technology continues on page 94.

SEE WHAT PENTON* TANK LININGS CAN DO



A 40-mil Penton lining was applied to all of the interior surfaces of this separator tank, using a straightforward adhesive system and conventional welding techniques. The tank is designed to serve as a decanter in the separation of carbon tetrachloride from weak hydrochloric acid with dissolved nascent chlorine.

In operation in processing system in a large East Coast chemical plant, this Penton-lined tank has successfully met all service requirements since its installation. Tanks for plating solutions, chemical milling operations, and the storage and handling of other corrosive fluids at elevated temperatures are typical of the many new uses where Penton linings are now proving their ability to outperform other materials in their class.

Lined by Electro-Chemical Engineering and Manufacturing Company with Penton sheet manufactured by National Vulcanized Fiber Co.

Penton linings readily convert carbon steel tanks into vessels capable of handling highly corrosive fluids at elevated temperatures. The ability of Penton linings to upgrade low-cost metal substrates in chemical processing systems has led to their widespread use in many areas where only high-cost materials were previously qualified to serve.

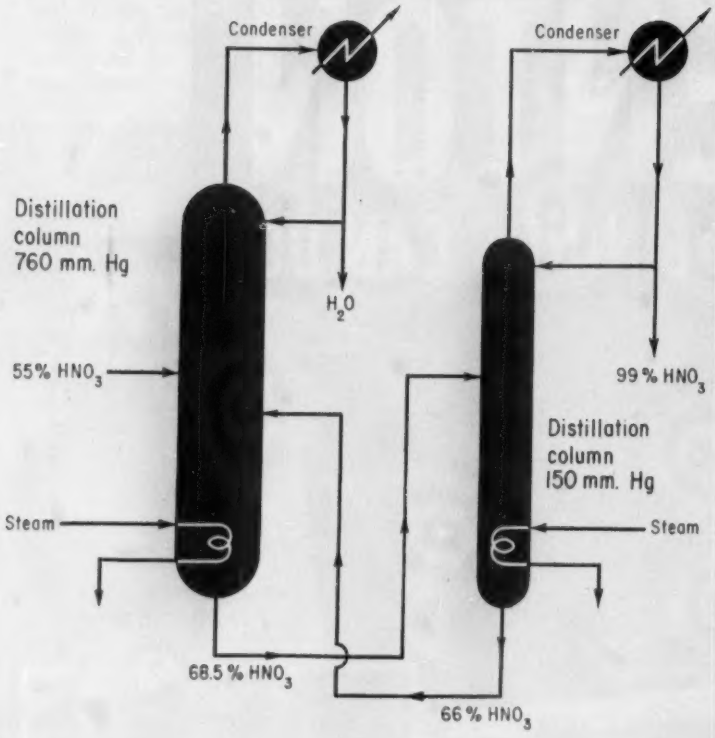
Linings made with this new thermoplastic are applied by the use of a straightforward adhesive system and conventional gas welding techniques. They provide a highly practical means of supplying the superior corrosion resistance offered by Penton to vessels in a wide range of shapes and sizes.

Find out how Penton tank linings may provide the answer to your chemical storage or handling problem. For additional information on materials and application techniques, and a current list of fabricators, call or write:

HERCULES POWDER COMPANY
INCORPORATED
Wilmington 99, Delaware

**Hercules registered trade mark for chlorinated polyether.*

CP60-2



Concentrating Nitric a New Way

Novel two-column process may cut costs of nitric concentration in small plants.

Engineers on this side of the Atlantic now have the chance to evaluate a brand new process for concentrating nitric acid: It's a simple two-column system patented by Pintsch Bamag (DBP 1,060,850) which operates without the usual H_2SO_4 or magnesium nitrate desiccant. Instead, process exploits the difference in composition of HNO_3-H_2O constant-boiling mixtures at differing pressures.

▶ **Azeotropic Shift**—In the first column, operating at 1 atm., dilute nitric concentrates to a 68.5% azeotropic mixture with pure water coming off overhead. In the second column operating at only 150 mm. Hg, however, the azeotropic composition is only 66%. This means that the feed stream of 68.5% is on the nitric side of the azeotrope curve so that 99.5% HNO_3 distills off while the 66% bottoms is recycled to the first column.

▶ **Pro and Con**—Main drawback of this process is that the product stream is only about 5% of the feed stream, meaning a high recycle load consuming steam to raise it back to boiling temperature at 760 mm. Hg. Advantage of this route is the simplicity of operation and low capital investment.

For small installations, low capital cost would probably outweigh higher steam consumption. However, Pintsch Bamag says that this process has not yet been proved commercially.

▶ **Where Does It Fit?**—Main question engineers familiar with nitric processes are asking themselves is where the economic breakpoint for this process will be. With present concentrating processes, above 50 tons/day HNO_3, the sulfuric acid route looks best. Below 50 tons/day, the low capital cost of magnesium nitrate systems (*Chem. Eng.*, July 28, 1958, p. 68) gives "Maggie" the nod. No one is yet sure where the new process might fit in.

Too, process might look more attractive in Germany because most H_2SO_4 reconcentrating systems there produce 98% sulfuric for recycle with losses of several percent. U. S. processes (such as the Chemico flowsheet) reconcentrate H_2SO_4 to only about 90% but losses are only a fraction of a percent.

Japanese Push Into Polypropylene Making

The Japanese are evidently getting set to stage a full-scale push into the polypropylene business. Within the last few weeks, at least seven Japanese chemical firms have indicated that was their intention and some have already applied to the Bank of Japan and the Ministry of International Trade and Industry (MITI) for permission to license foreign know-how and build facilities.

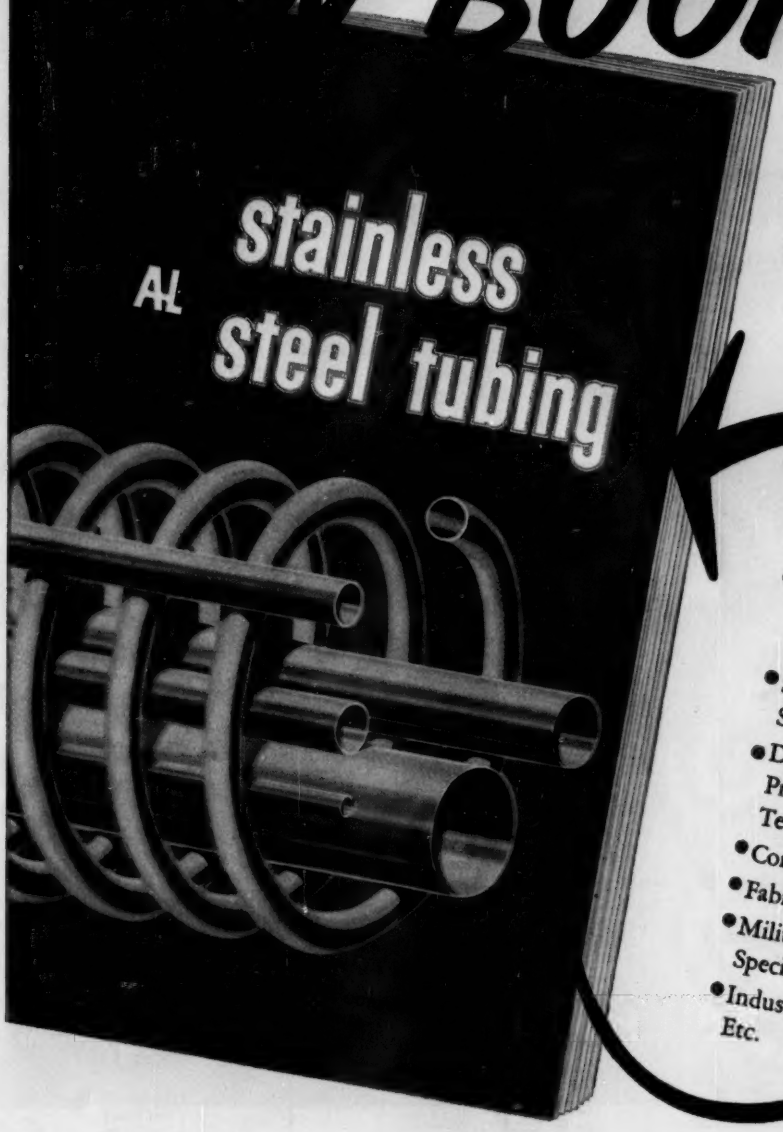
Mitsui Chemical is seeking to build a $9-million, 19,000-ton/yr. plant (half of the output for fiber and half for resin) at its Otake facility near Hiroshima using Montecatini's flowsheet.

Ube Kosan is planning to build a 5,000-ton/yr. plant, also to follow the Montecatini route, as part of a $22-million program to get into petrochemical processing.

Mitsubishi Petrochemical has signed a letter of intent for the Italian polypropylene process, intends to apply to MITI shortly. And others with applications on file with MITI include Sumitomo Chemical, Nissan Chemical, Toa Nenryo (a Standard Vacuum subsidiary) and Showa Denko.

Processes & Technology continues on page 96.

NEW BOOKLET on STAINLESS STEEL TUBING sent on request



PARTIAL LIST OF CONTENTS

- Stainless Steel grades
- Product data on Seamless Tubing and Welded Tubing
- Size range Stainless Pipe & Tubing
- Design data—Internal Pressures—Elevated Temperatures, etc.
- Corrosion resistance
- Fabrication data
- Military & Aircraft Specifications
- Industry's uses

Etc.

This 36-page booklet newly published by Allegheny Ludlum is packed with technical data and authoritative information on both welded and seamless stainless steel tubing. There are more than 20 tables for ready reference and many photographs.

It will be helpful to design engineers and others interested in solving the many critical and demanding pipe and tubing applications.

The booklet contains the best and latest information available on product and design data on the subject—the partial contents listed give some idea of its scope. You'll want a copy for your files.

Write for your free copy of Allegheny Stainless Steel Tubing, ***Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania. Address Dept. CE-4.***

1287

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EVERY FORM OF STAINLESS . . . EVERY HELP IN USING IT

Outlook Brightens for Sulfite Pulping

Magnesium-base digestion plus improvements in several chemical recovery processes are pumping life back into the ailing sulfite pulping route.

"These processes are almost sure to revitalize the sulfite pulping industry."

"I don't know how sulfite could have lasted this long without knowing some of the things that were revealed today."

These were some of the enthusiastic comments of participants in an all-day session on sulfite pulping processes at the recent TAPPI* meeting in New York. Several solutions were offered that day to the main problem plaguing sulfite pulpers: How to recover pulping chemicals and cut down on the stream pollution load.

One of the most promising answers is magnesium-base cooking. The most recent development in Mg pulping is the Magnefite process, licensed by Babcock & Wilcox, which is a modification of the basic magnesium bisulfite route (*Chem. Eng.*, Sept. 8, 1958, pp 114-117). Two main changes are that cooking is done essentially free of excess SO_2 in liquor and at high temperature—about 330 F.

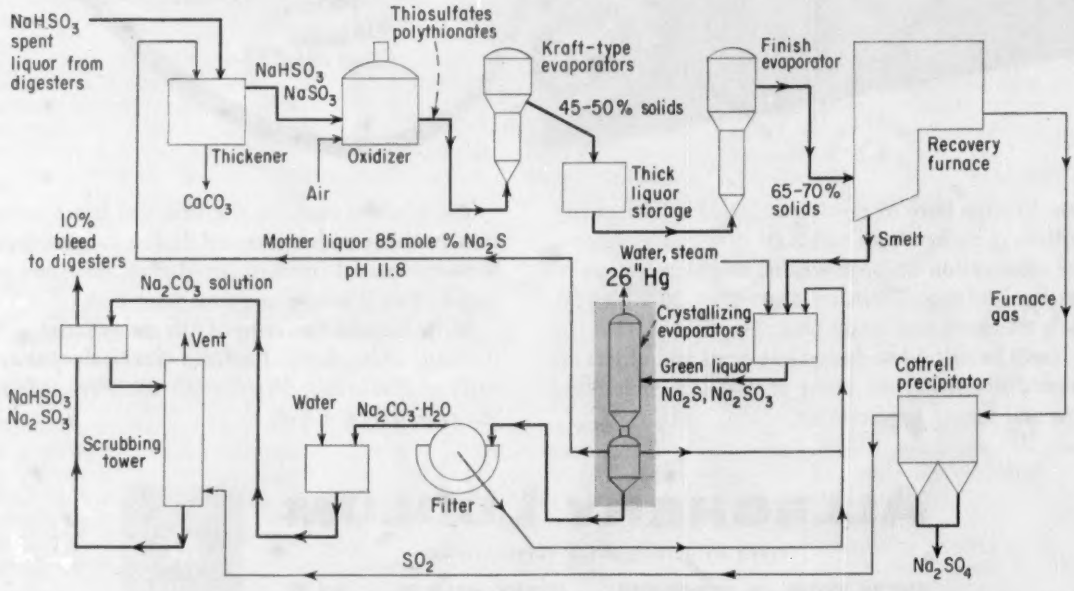
▶**Accent on Versatility**—Magnefite has the advantage of relatively simple chemical and heat recovery and can also pulp woods such as pine and poplar normally not suitable for sulfite digestion. Pulp yields and strength are also claimed to be higher with this process.

Magnefite process, with full recovery system, is being installed at an unidentified mill in Sweden and a mill in Wisconsin is now using it without recovery while installing recovery equipment. According to Magnefite proponents, outlook for the process is brightest in parts of the country (such as Wisconsin) where traditional sulfite woods like spruce are giving out and pulpers have to turn to "scrap" woods.

▶**Standard Flowsheet**—Magnefite chemical recovery is similar to the system used at Brown Co. in Berlin, N. H. (*Chem. Eng.*, Sept. 8, 1958, pp. 114-117), with the addition of a liquor fortification step where makeup SO_2 is added to the acid water from the cooling tower to give a 5% SO_2 content (2.5% free, 2.5% com-

*Technical Association of the Pulp and Paper Industry.

Vacuum overcomes plugging in WP chemical recovery process



in blending polyethylene at the Houston Plant ....

Celanese
CORPORATION OF AMERICA

Achieving complete homogeneity of blend in remarkably short cycles, the Patterson ThoroBlenders serving Celanese Corporation at their Houston Plant cross-blend the entire production output of polyethylene, in both pellet and flake form.

The plant is equipped with 5 production ThoroBlenders ranging in size from 8 ft to 14 ft in diameter, and a 6 ft pilot model. Bodies of all ThoroBlenders are of stainless steel, and the production-size units are equipped with air-operated charge and discharge doors.

If, like Celanese, you have a need for faster, completely uniform product blending in dependable, easily-cleaned units, we suggest you check the advantages ThoroBlender can bring to your operation. Write, phone or wire for a prompt consultation.

THE *Patterson* FOUNDRY AND MACHINE COMPANY
EAST LIVERPOOL, OHIO

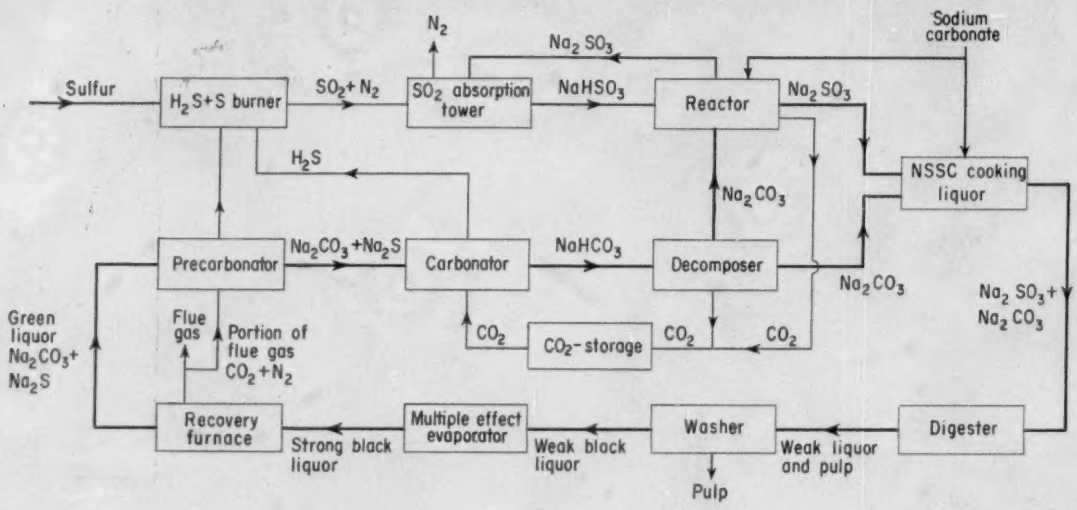
USES

6 Patterson THORO BLENDERS

for

- ***UNIFORMITY OF PRODUCT***
- ***SHORT BLENDING CYCLE***
- ***RAPID EASE OF CLEANING***

How Sivola process recovers chemicals in neutral sulfite semichemical pulping



bined) in the acid returned to the digester.

Chemical savings (with recovery system) are pegged at $3.30 per ton of pulp compared to calcium-base systems. Thermal recovery (13,000 lb. steam/ton pulp at 45% yields) is 5-8% greater than sodium-base recovery systems.

▶**No Longer Experimental**—Western Precipitation's sodium-base recovery process (*Chem. Eng.*, Oct. 1957, pp. 166-168) is reported by developer Robert Q. Boyer to be out of the experimental phase and fully operable—proved out at Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis. Cost estimates show that for a 200-ton/day mill, the WP system will show a return equal to that on an average paper mill investment.

Main trouble with the WP process had been formation of anhydrous sodium carbonate in the crystallizers. When slurry was pumped to the settler and filter, anhydrous powder would recrystallize to the monohydrate accompanied by plugging of lines and equipment.

No phase diagrams existed for this system to guide crystallizer operation. But a hint picked up at last year's TAPPI meeting led developers to the International Critical Tables which gave vapor pressure of sodium carbonate monohydrate as a function of temperature. These data led engineers to run the crystallizers under a 26-in. vacuum—clearing up the operating troubles overnight.

Sulfur dioxide is recovered at about 97% efficiency in a sodium sulfite-bisulfite solution from furnace flue gases in a stainless steel-lined tower. Sodium loss is about 2% requiring a makeup of 4 lb. Na_2O per ton of pulp.

▶**Add Absorption Area**—The Mead Process (*Chem. Eng*), Feb. 1957, pp. 168-170) has licked one of its major drawbacks—an unpleasant odor—by adding a fourth absorption tower and a venturi scrubber to eliminate particulate matter from the stack. Effluent at the Lynchburg, Va., installation now contains only 0.03% SO_2 and 0.01% H_2S. Now used only on neutral sulfite semi-chemical (NSSC) liquors, Mead process backers say it can also be adapted to acid sulfite pulping.

Engineers also have added a small gas-fired burner to preheat air going to the recovery boiler, cutting fuel requirements from $1 to 25¢/ton pulp. Over-all mill recovery is about 80% for sulfur and 85% for sodium, requiring a makeup of 150 lb. Na_2CO_3 and 30 lb. S per ton of pulp. Mead advocates emphasize that process is now a proved success and operation is trouble-free.

▶**Two-Stage Cooking**—The Sivola process, licensed by Combustion Engineering, has received two new votes of confidence abroad. Original installation at the Rauma-Repola plant in Rauma, Finland, is enlarging its recovery system to boost dissolving pulp capacity from 70,000 to 130,000 metric tons/yr. And another Finnish company, Tampella Oy, is erecting a 315-metric-ton/day NSSC mill using Sivola recovery (see flowsheet).

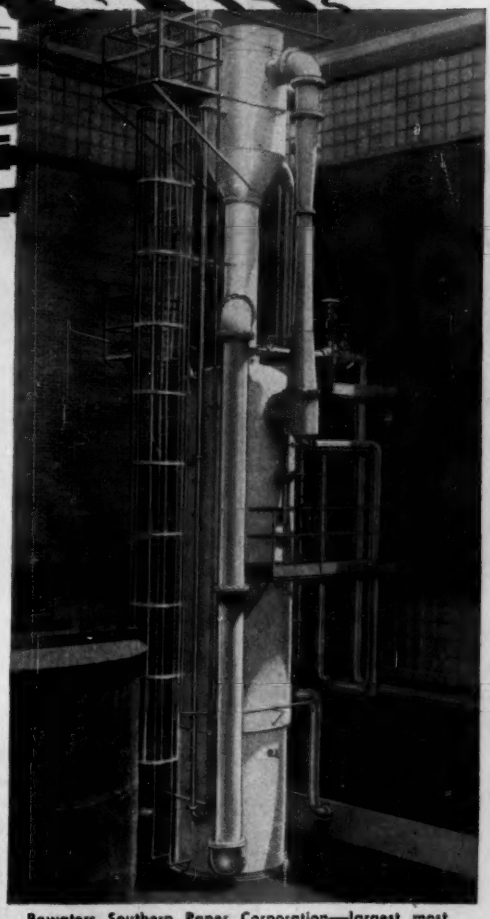
Two-stage cooking has aroused much interest lately, some of the advantages cited being reduced cooking time, variety of woods handled, low steam requirements, low bleach requirements and lower chemical makeup. The Sivola flowsheet, based on carbonation of the clarified green liquor, can be adapted to handle a variety of two-stage digestions, including $NaHSO_3$-Na_2CO_3 and $NaHSO_3$-liquid SO_2 systems.

The Swedish Stora Kopparberg recovery process can also be adapted to two-stage cooking. A mill in Canada is currently under construction to utilize the SK process with a two-stage cook; a Swedish mill uses it with single stage digestion.

Processes & Technology continues on page 100.

"Water, water everywhere..."

...and not a drop under 95°!



Bowaters Southern Paper Corporation—largest, most modern newsprint mill in the South uses Graham Steam Vacuum Refrigeration.

Will this be your problem in July?

Perhaps Old Sam Coleridge's famous quotation may well apply to your situation. Graham Steam Vacuum Refrigeration offers you the best solution to your process water requirements.

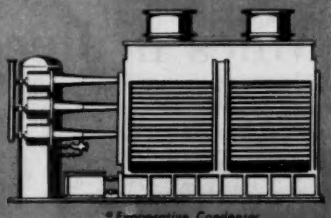
If you are going to be in need of colder water this summer, today is the time to plan for it.

Dependable, low in all costs, and tried and proved in hundreds of plants throughout the world.

Don't overlook Graham Steam Vacuum Refrigeration.

Write for Bulletin

A combination you cannot beat — a Graham Steam Vacuum Refrigeration System with the Aquadyne*



*Evaporative Condenser

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Factory: Batavia, N. Y. Other Graham precision-built products: Steam Jet Ejectors, Heliflow Heat Exchangers, Monobolt Heat Exchangers, Deaerating Heaters, Surface and Barometric Condensers.

COKING DRUM, aboard railway flatcar, ends its well-engineered, 325-mile trek along Intracoastal Waterway.

Coker Moves 325 Miles in Record Lift

To reclaim used coker, Texas refinery completes one of largest relocation jobs ever undertaken.

American Oil Co. recently undertook the ultimate in moving jobs when it transferred a shutdown giant coking unit from its Destrehan, La., refinery to Texas City, Tex.

By this move, Amoco salvaged two coking drums originally constructed on site. By virtue of their size, such drums could not move far on usual highway or railroad rights-of-way. But Amoco rolled, floated and hauled the drums to their new location and a successful return on stream last month.

Moving contractor, Tellepson Construction Co. (Houston), first dismantled the 230-ft. tall superstructure, consisting of some 10,000 steel beams, pipe, valves, pumps and other equipment. Carefully recorded number and color codes on each piece prevented hopeless scrambling.

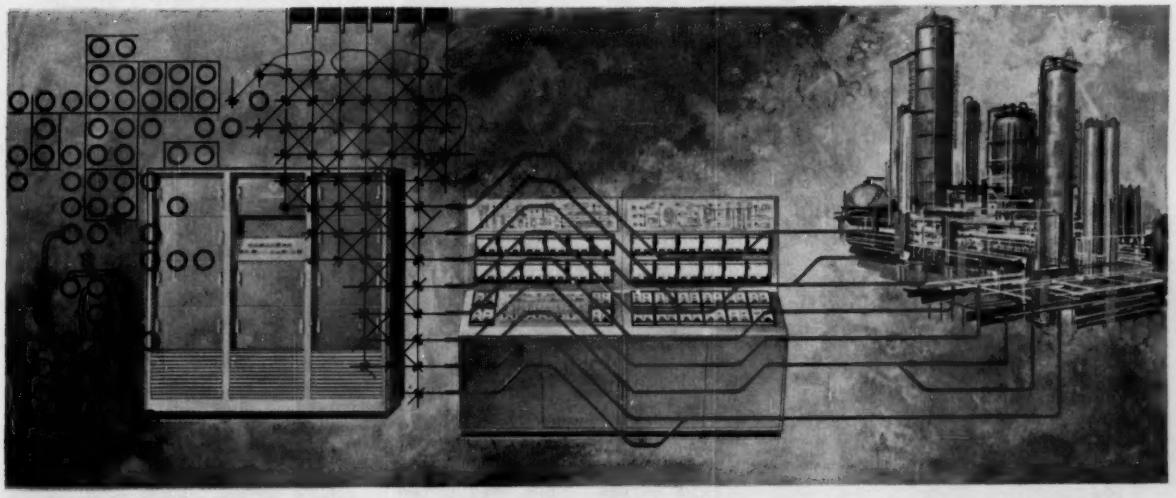
▶ **Easy Water Route**—After dismantling the superstructure,

the instruments

the computer

the systems engineering . . .

now Foxboro brings you all three



A dynamic new force in computing control is now available to the process industries. Foxboro, and the Radio Corporation of America, contributing their individual capabilities, bring industry its first completely integrated computing control system. From Foxboro, the instrumentation, the knowledge of process dynamics. From RCA, the digital computer, and its special electronic techniques. A breadth and depth of talent available with overall systems responsibility through The Foxboro Company. When you are investigating the feasibility of computing control, look into this new force. The Foxboro Company, 104 Norfolk Street, Foxboro, Massachusetts, U. S. A.

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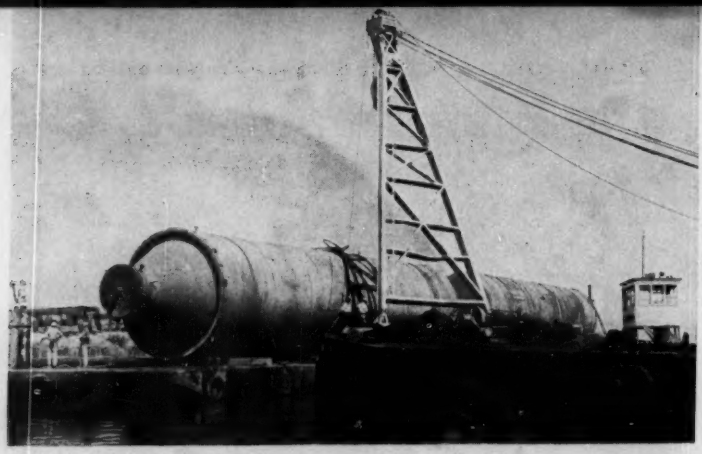
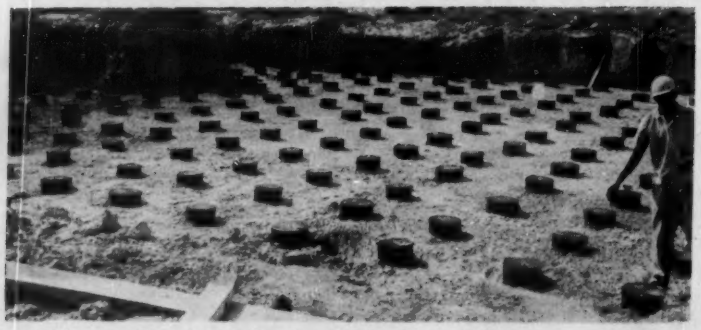
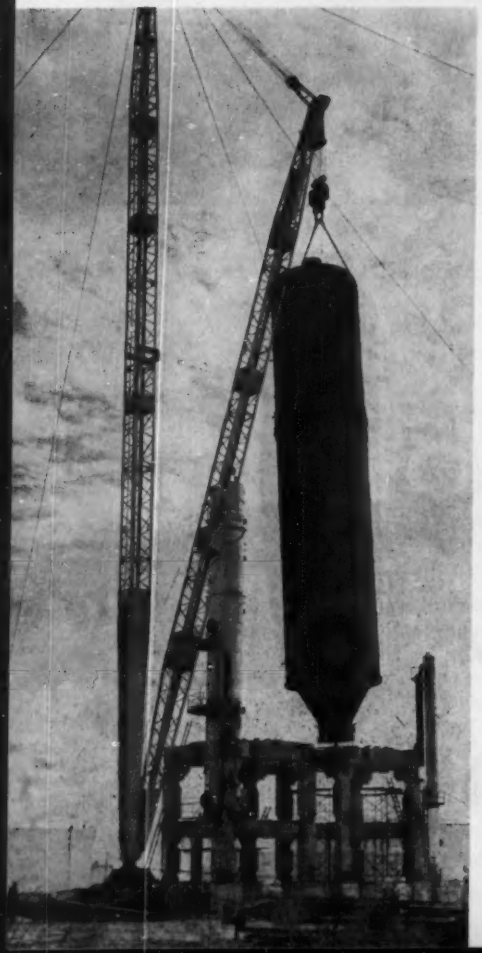


CANAL BARGE carries coker drums to Texas City docks.



PILES assure firm foundation for giant coking unit.



COKING DRUM is positioned in tall superstructure.

Tellepson rolled the 18-ft.-dia., 155-ton coking drums over the nearby Mississippi River quay onto barges. Thus, began the smooth, 4½-day journey down the Mississippi River, through the Intracoastal Waterway and up Galveston Bay to Texas City.

There, waiting cranes and flatcars took over; coking drums went on a 6½-hr. railway trip to Amoco's nearby refinery. Even for this short haul, a number of stanchions and other obstructions were shifted from the right of way to allow passage.

Meanwhile Tellepson engineers made ready the Texas City site for the heavy coking drums; when fully charged with coke, each drum alone weighs 555 tons. So, more than two miles of supporting piles and 3,000 cu. yd. of concrete foundation assured a firm foundation for the unit.

At the end of a well-engineered, trouble-free trip from Destrehan, the coking drums arrived at the gate of Amoco's readied refinery. But a strike of refinery personnel halted entry; and only after a few anxious moments of negotiation, did the coker drums pass through a special gate and reach the prepared site.

▶ **Final Reassembly** — Then Tellepson engineers began reassembly of the 10,000-piece superstructure, using the number and color codes as guides. Erection proceeded rapidly despite an 85-mi./hr. hurricane during one part of the reconstruction. With the coking unit completely reassembled at the new site, coking operations began turning out product last month.

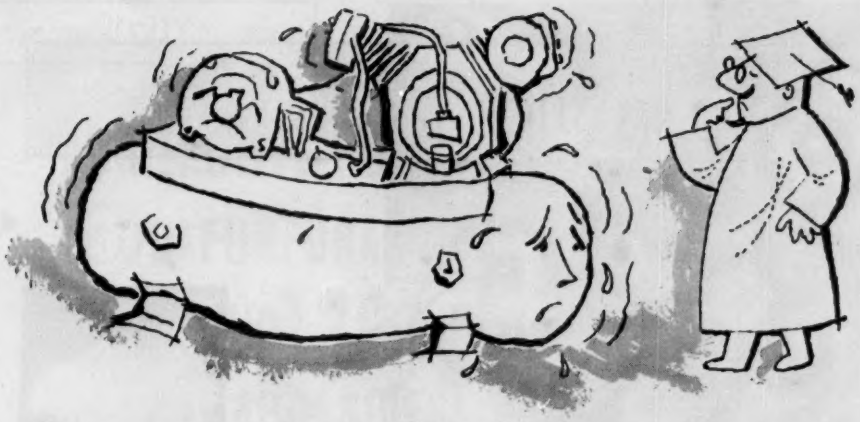
At its new site, the coking unit wrings 6,000 bbl. of gas oil, 2,300 bbl. of gasoline and 400 tons of coke out of 10,600 bbl./day of thick, reduced crude residue from the nearby catalytic cracker. Coker feed is first preheated to 910 F. in a huge furnace, which was also moved from the original site at the Destrehan, La., refinery.

Preheated residues flow into the coker, where high heat breaks them down to volatile hydrocarbons plus byproduct coke, until some 400 tons of coke accumulate. Then residue feed stream shifts to twin coker drum and steam starts to strip valuable volatiles, that are trapped in coke.

Once product vapors are driven off, a 1,900-psi. jet of water tears coke from coker walls in chunks that fall via chute into a byproduct basin.

AviSun Corp., a joint venture of American Viscose Corp. and Sun Oil Co., steps deeper into the polypropylene business with new plans for a 50,000-ton/yr. plant in eastern U. S. Forerunners of giant new plant are AviSun's 10,000-ton/yr. plant at Port Reading, N. J., and 5,000-ton/yr. film plant at New Castle, Del. AviSun has awarded the engineering contract for the new plant to Bechtel Corp., San Francisco, Calif., but declines to reveal the selected plant site.

Industry News continues on page 220.



why an overworked air compressor

can rob your profits...

LOW AIR PRESSURE at portable air tools or air-operated equipment produces the same condition as a dull saw: It requires more operator effort; the job takes longer; you're wasting manpower.

IF YOUR DISTRIBUTION SYSTEM is adequate and lines are tight, low tool pressure indicates the need for more compressor capacity... Your Ingersoll-Rand AIRengineer can quickly help you determine how much and where additional compressor capacity will give you faster, more profitable production. Call him today at your nearest I-R Branch Office or authorized distributor.

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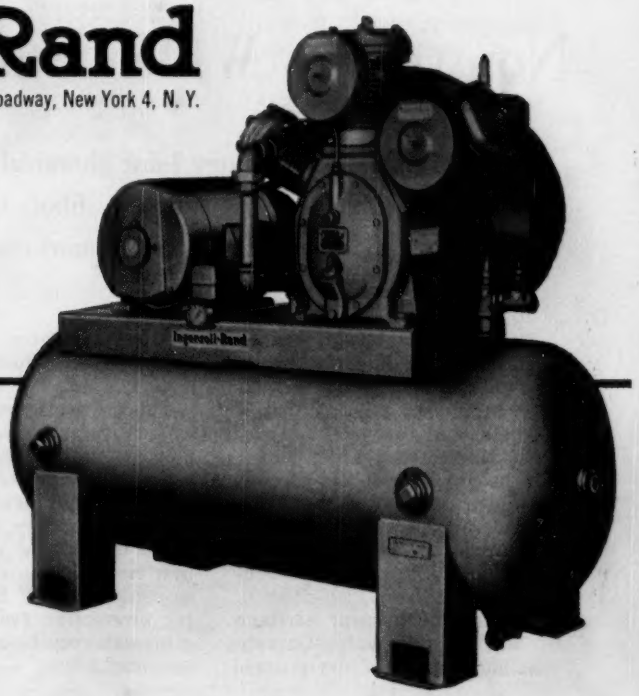
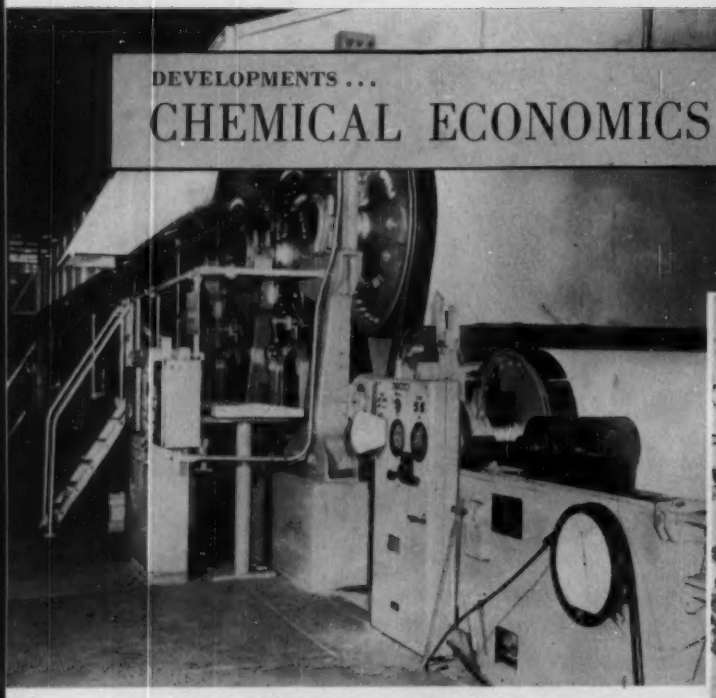
11 Broadway, New York 4, N. Y.

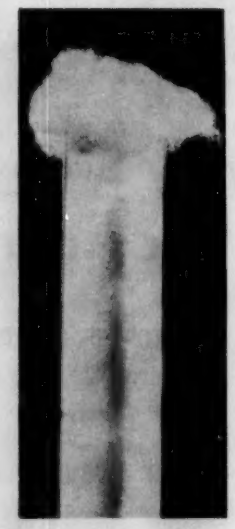


Ingersoll-Rand Type 30
Air-Cooled Air Compressor
½ through 20 hp

115A3



PRODUCTION RATES are up via new use of modified paper machines, such as the C. H. Dexter Co. unit for nonwoven Dacron, shown above.



QUALITY is growing with use of synthetic fibers, new binders. Right, Celanese acetate web material. Left: Carbide's plastic binders in fiber form.

Nonwovens Widen Stance for Volume

Papermaking technology joins chemical industry's binders and synthetic fibers to give nonwoven fabrics a base for major textile markets.

The paper industry is poising itself to lend a hand that may pull nonwoven fabrics into the main stream of existing textile markets, and invent some new ones. Nonwoven textiles which are the products of wet-process machines adapted from papermaking are making their first commercial appearance.

Production speeds approaching papermaking's 1,000-ft./min. norm are the natural heritage of such equipment. Current maximum speed of dry-process textile machinery conventionally used to produce nonwovens is 40 ft./min.

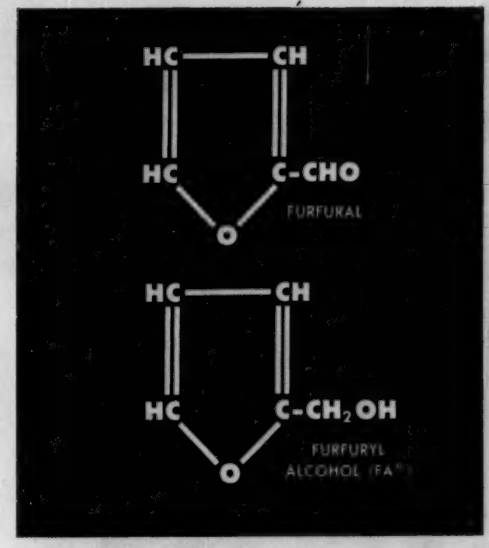
This is the second time nonwovens have benefitted from new blood since their origin in the textile industry a quarter century ago. Intervention of the chemical industry in the early '50's, by raising quality with new raw materials, raised nonwovens' share of textile industry production from the negligible category to a current 2% by weight.

Both of nonwovens' major constituents, fiber webbing and binders, felt this chemical impact. To the textile industry's waste cotton fiber was added waste and virgin viscose fibers, acetate, nylon, polyesters and acrylics. Today only about 28 out of 70 million lb./yr. of fiber consumed is cotton; about 30 million is viscose, 6 million is acetate and 6 million goes to other synthetics.

To natural gum and starch binders were added polyvinyl

Benefits of QO Chemicals

AS REACTIVE SOLVENTS, QO® FURFURAL AND QO FURFURYL ALCOHOL PUT ABRASIVES IN A "BIND"



QO Furfural and QO furfuryl alcohol are used as solvents and wettants of phenolic resin binders by many manufacturers of grinding wheels, brake linings and other friction elements. One of the big benefits from the use of furfural and furfuryl alcohol is that they do not volatilize but remain as part of the final bond. Here are the results of our laboratory tests on this question:

Furfural and FA readily dissolve the phenolic resins. Reactivity is shown by tests in which we added (a) ten parts and (b) twenty parts of furfural and furfuryl alcohol to one hundred parts of resin, triturated the system to thoroughly distribute the solvent in the resin, then baked an aliquot of each system in a shallow pan at 80°C. for 3¾ hours, 100°C. for 24 hours, and 180°C. for 24 hours. Precaution was taken to make sure that the samples did not contain free furfural or furfuryl alcohol after the baking cycle. The samples were weighed before and after baking, and compared with control samples of the resin containing no furfural or furfuryl alcohol.

REACTION OF FURFURAL AND FA WITH PHENOLIC RESINS

Resin*	Percentage Added		Percentage Furfural or Furfuryl Alcohol Retained
	Furfural	Furfuryl Alcohol	
Resin #1	10		90
Resin #2	20		87
Resin #3		10	94
Resin #4		20	86
Resin #5	20		85
Resin #6		20	83
Resin #7	20		88
Resin #8		20	85
Resin #9		20	77
Resin #10		20	87
Resin #11	20		88
Resin #12	20		87
Resin #13		20	84
Resin #14 (sirup)	20		69
Resin #15 (sirup)		20	80

*Resins identified upon request.

It is evident that a high percentage of these solvents reacts with and remains a part of the final resin bond. This suggests that if you are in a "bind" on a problem requiring a reactive solvent, you ought to consider QO furfural or QO furfuryl alcohol.

For more complete information, write for Bulletin 126.

The Quaker Oats Company

CHEMICALS DIVISION

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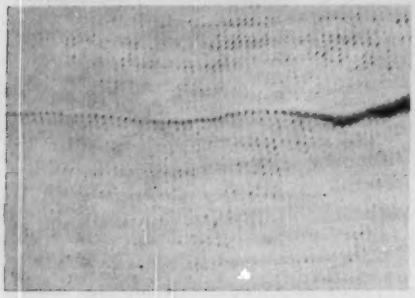
Present 125-Million-Lb. Nonwovens Market May Add Girth in Either or Both:

DURABLES
Now, shape is given to quality garments by interlinings made by Pellon. Future may yield outerwear competitive with wovens.

DISPOSABLES—Now, shop towel made by Chicopee has absorbency, strength, woven look. Future may yield disposable apparel.



acetate, polyvinyl chloride, butadiene-styrene, butadiene-acrylonitrile and acrylic latex binders. Current binder consumption is in the order of 30 million lb./yr.

Now papermaking technology modified for nonwovens promises to maintain or improve textile properties while reducing costs by speeding up production to 20-80 times current rates. Progressing along this route, nonwovens could one day bid from strength for markets in:

Disposables—The "Brave New World" dream market of outerwear garments, attractive and strong enough to invite popular consumption yet inexpensive and fragile enough to discard after limited use, might be a late flower of this three-industry cross breed. Apparel takes over 2 billion lb./yr. of fiber to present 125-million-lb. total consumption of nonwovens.

Durables—On the other hand, development of nonwoven garments that so closely approach wovens in durability and aesthetic satisfaction, that they can afford to approach their prices, are also getting the benefit of substantial attention.

If either of these things can be done for garments, it can also be done for home furnishings—draperies, slip covers and upholstery materials, table and bed linens, etc.—which currently consume another 1.3 billion lb. or so of fiber.

These markets represent ultimate goals. But movement toward them has accelerated.

• Last September, Kimberly-Stevens Corp. was formed with the stated aim of marrying the speed and economy of paper making to the textile industry's savvy in styling, finishing and marketing. Company is a joint subsidiary of Kimberly-Clark, large manufacturer of disposable paper products, and J. P. Stevens producer of industrial and consumer fabrics.

• At the turn of the year, C. H. Dexter & Son, 192-yr.-old industrial paper company, announced its entry into the textile field, with a high-quality nonwoven Dacron interlining. Called Dextex, product is being marketed by Earl-Tex products, a jointly-owned company formed expressly for the purpose by the two largest suppliers of linings and interlinings in the world. The textile fiber department of Du Pont engineered a fiber suited to paper processing methods.

• In its 1959 annual report, St. Regis Paper Co. described a joint project with American Viscose aimed at utilizing papermaking technology on textile fibers to make nonwovens. One result: sale of 10,000 disposable bags for packaging such products as seed corn, a conventional market for woven cotton.

• At TAPPI's national meeting in February, Hollingsworth & Vose—paper manufacturer of Walpole, Mass.—introduced a family of nonwovens made on paper machines from a combination of rayon, nylon, Dynel and other synthetic fibers. Called Hovotex, the family's initial use is in drapery linings.

Other paper companies, including Riegel and Scott, are active in the field. However, with '59 paper production at a record 34 million tons, scale of the industry setup for volume is outsize by textile- or even chemical-industry standards. Evidence already in indicates procedures that may be generally followed to squeeze into the smaller mold, i.e. team up with a textile marketer and create a separate operation.

▶ **Blurry Identity** — To effect this separation requires some sharpening of the definition of nonwoven fabrics. Originally they were clearly textiles: They used traditional raw materials, production techniques adapted from felting and other textile processes. Only markets and properties were confused; because of low-quality—and the basically paper-like webbed nature of the sheet—many original nonwovens competed with the low end of the specialty paper market.

Now neither raw materials nor production techniques are firmly planted in textiles. Span of end-product properties has widened to include, not only quality textiles but also products closer to reinforced plastics or paper than they are to textiles.

The specialty paper market now stands at about 1 billion lb./yr. That its preserves still form an important part of nonwoven fabric markets is evident in an estimate made by Howard E. Shearer of American Viscose of the distribution of fibers in nonwoven fabric applications in

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a glycol, i.e., by OH replacement: $HOCH_2C \equiv CCH_2OH \xrightarrow{X} XCH_2C \equiv CCH_2X$

to form cyclic compounds, i.e., trimerization:

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INDUSTRIAL CHEMICALS DEPARTMENT

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1957-1958: Of 80-100 million lb. total fabric, 25-30 million went into low-end industrial products such as paddings, wipers, pressed felt; another 25-30 million lb. went into high industrial uses such as towels, laminates, filters, coated fabrics; 20-25 million went into household uses including draperies, table covers, sanitary products; 10-15 million lb. went into such apparel as shoe fabric, inner and outerwear, liners, ribbons.

▶ **Separate Entity**—However, a St. Regis spokesmen stated last year that, to his company, "a synthetic paper is designed to replace a paper subtance, while a nonwoven or bonded fabric is designed to replace a textile."

Recent corporate action of paper companies, recorded above, tends to follow this line. Their contribution to textile-type nonwoven products may be set apart for marketing in a distinct category whose constants are traditional textile end-product properties and applications.

▶ **Sibling Products** — But they seem inclined to retain for their own purposes sibling products whose properties are not textile in character. For example, nonwovens which are papery in character are being made via paper technology, not only from what the textile industry looks upon as synthetic fiber, but from synthetic mica, potassium titanate, glass, etc. These products fall squarely in the category described, for now at least, as synthetic paper. From the paper industry's point of view, the products also fall logically into existing distribution channels for specialty paper products.

▶ **Building in Distinctions**—To emphasize the distinctions between paper and nonwoven fabrics and to equip the latter to battle for volume textile markets on equal terms, development work is still needed. Improvements must be made in drape, texture, feel or hand, ability to take dye, strength—all at the right price. Kind of fiber, kind and amount of binder, length of fiber in relation to diameter—all affect these properties.

▶ **Wet-Process Problems** — Wet processes used in papermaking, even the new modifications, are limited to using a maximum fiber length of ¾ in. Textile processes, including the modifications for nonwovens, use nothing under ½ in. and 1 in. is a more conventional minimum.

As a result, many products made by the wet process, such as Kimberly-Stevens' new Kaycel, have a papery texture. And to get the strength of fabric, Kaycel needs reinforcement from a yarn scrim. Filler fibers are bonded to the scrim in much the same way that paper pulp is laid on the screen of a paper machine.

▶ **Properties Gained** — On the other hand, sufficient drape and strength is claimed for C. H. Dexter's Dextex to compete for an application considered something of an acid test: interlining for collars and lapels of men's wash-and-wear suits.

At $3/lb., it competes with $1.25/lb. for woven Dacron taffeta; but it goes much further and is desirably lighter, running 2.5 oz./sq. yd. compared to 5.4 oz./sq. yd.

And the Dextex process does not require a binder or scrim, thanks to an undisclosed method Du Pont has developed for treating Dacron. Dextex process adapts to polyamides and acrylics.

Hollingsworth & Vose Hovotex, too, boasts drape and strength sufficient for such applications as drapery interlinings. Binder is acrylic.

▶ **Flexible Binders** — Acrylics are being used as binders for old-style dry-process nonwovens more and more often because they provide a soft hand, possess good adhesive properties and color stability. The binder situation for the new wet-process products is still wide open.

Pigments are being incorporated into acrylic emulsions, thus combining functions of binding and coloration. Fabrics made in this way are resistant to washing or drycleaning.

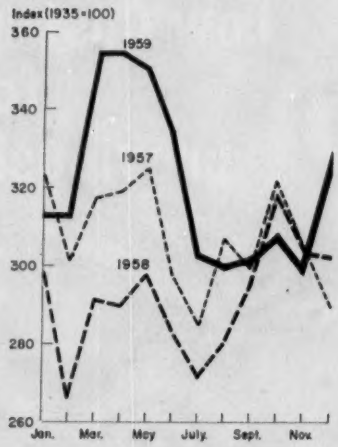
Polyvinyl chloride latexes provide fabrics with a leathery finish. Though they are tough and have good wet and dry strength, they are not very elastic.

Compositions of butadiene-acrylonitrile and butadiene-styrene offer a combination of good adhesive and elastic properties. A short cure is necessary for those of high butadiene content as they are usually more rubbery.

▶ **Speed Awaits Need** — While the greater production rates of the wet process over the dry process may have a more favorable fiber to fabric conversion cost, one papermaking machine converted to nonwoven fabric and working at a normal 1,200 ft./min. could produce over 110 million lb./yr., almost the entire yearly volume of nonwovens. Markets for bonded fabrics must be developed before high production units will be built by the paper industry.

Both C. H. Dexter and Hollingsworth & Vose turn out their new nonwovens at speeds they describe as substantially greater than maximum dry-process nonwoven machine speeds of 40 ft./min. Kimberly-Clark turns out Kaycel at 600 ft./min., almost papermaking speed.

Consumption Index



Consumption by Industries

	Nov. (Final)	Dec. (Est.)
Coal products	7.1	10.2
Explosives	9.1	10.4
Fertilizer	73.7	79.5
Glass	26.1	25.0
Iron & steel	1.3	22.0
Leather	4.4	4.4
Paint & varnish	29.2	28.8
Petroleum refining	30.9	32.9
Plastics	34.7	36.1
Pulp & paper	41.0	37.8
Rayon	24.6	26.7
Rubber	6.8	7.4
Textiles	10.5	9.5
Total	299	330.7

GAULIN G.T.A.

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GTA Bulletins

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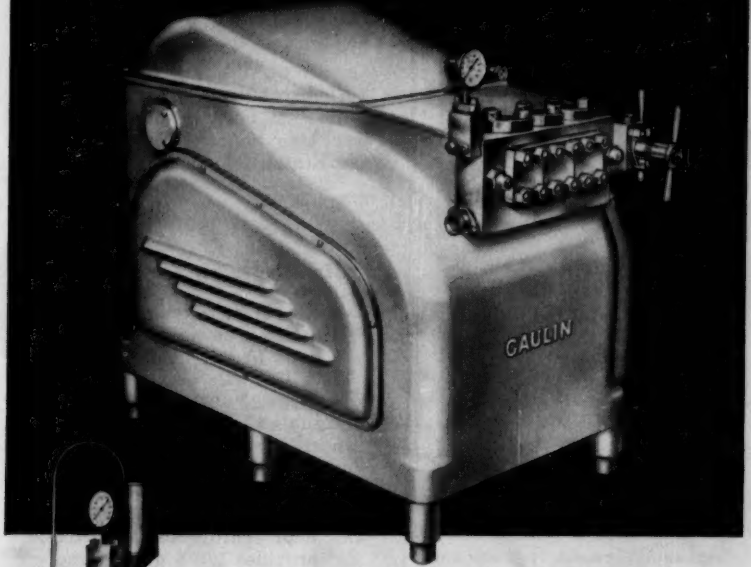
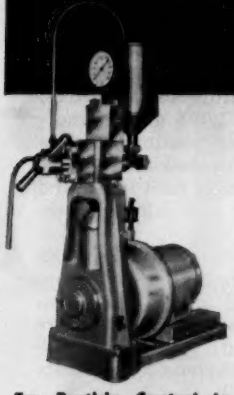
And Gaulin Homogenizers Provide the Practical Solution to Particle Control





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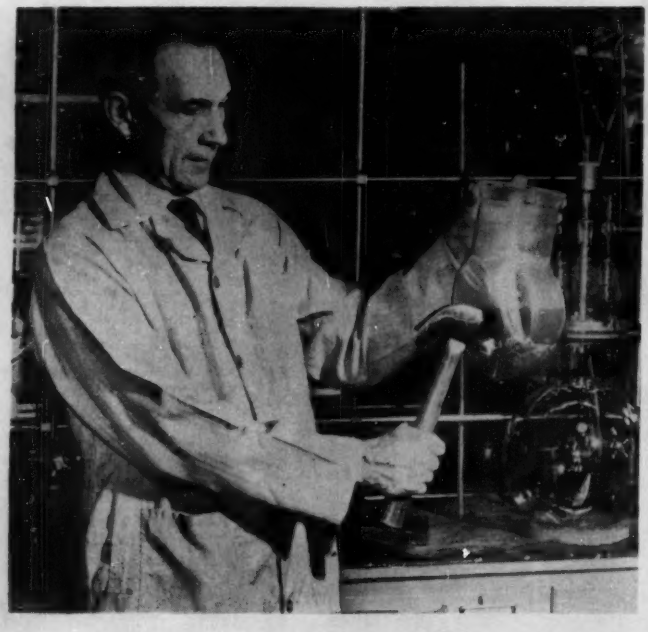
DEVELOPMENTS . . .

CHEMICAL PRODUCTS EDITED BY N. P. CHOPEY



New Coating a Safety Aid for Experimenters

A new plastic coating, easily applied to glassware by spraying or brushing, protects experimenters against flying glass and chemicals in the event of breakage or explosion. The plastic is resistant to nearly all chemicals for a long enough time to permit their recovery, thus avoiding loss of the material being processed.

The coating can also be used to protect vacuum systems. Other applications include sealing joints and stopcocks, building up equipment handles, and coating tongs and clamp rings. The material augments the resistance of glass to breakage from mechanical shock. — Ace Glass Inc., Vineland, N. J. 110A

Dihydroxyacetone

Improved fermentation makes organic chemical available industrially.

Dihydroxyacetone, a fermentation product of glycerine and a reportedly versatile intermediate, is now available on a commercial scale. Formerly it was largely a laboratory curiosity, considered too expensive and too sparsely available for use as an industrial chemical.

Plans are under way to develop uses for the material, designated DHA, as an intermediate in the manufacture of food emulsifiers, plasticizers, fungicides, alkyd resins and other products. Possible uses in connection with paper, textiles, baking and tobacco have also been mentioned. Applications to date have been in the fields of cosmetics and medicine.

Commercial availability is due to improved fermentation procedures. Economic yields are now possible because of increased efficiency of the bacteria which act as fermenting agents on the glycerine. The period required for fermentation has been reduced from weeks to hours. — **Wallerstein Co., Staten Island, N. Y. 110B**

Polyethylene

New resin gives economical greaseproofness, relatively wide heat sealing range.

A new polyethylene resin, designated Petrothene 205-15, is reported to have numerous favorable properties for coating applications. It permits good heat seals over a relatively wide range of sealing temperatures, and provides 100% greaseproofness at lower coating weights than those needed with other resins of similar melt index and density (3.0 and 0.924, repectively).

The material is easily processed. When coated under optimum conditions (melt temperatures over 575 F. are recommended), it develops maximum polyethylene-to-substrate bond strength.

It adheres with a wide variety of substrates, and its good coating characteristics extend to nonporous substrates such as cellophane and foil as well as porous surfaces.

Flow characteristics are well suited for high-speed extrusion molding. Coatings as thin as

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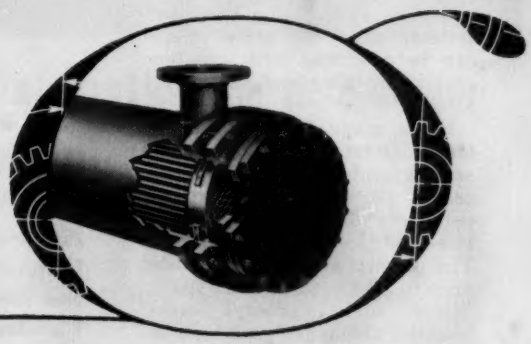
exch  anger

0.5 mil can easily be applied. Neck-in is reduced to a minimum, and polymer build-up at the die is said to be virtually eliminated.—**U. S. Industrial Chemicals Co., New York. 110C**

Elastomer

Modified version of fluorinated synthetic shows improved workability.

Minnesota Mining & Manufacturing has announced a significant bettering of the workability of its Fluorel KF-2141 Brand Elastomer, a product which is finding application in aircraft, missile, automotive and chemical industries.

The improved version, which will be marketed with no change in name, has a Mooney scorch rating almost three times that of the product as originally introduced. It provides a fast cure with good heat aging qualities, and retains all other characteristics, including low compression set after curing.

Applications for Fluorel elastomer to date have included "O" rings, gaskets and seals for high-temperature systems conveying acids, bases, solvents, oils and fuels. Using the new version, many of these items can be produced with greater ease of molding and fewer rejects.

Parts made from the elastomer can be used in continuous service at temperatures in excess of 400 F.; exposure to temperatures above 600 F. can be tolerated for limited periods. The product shows good resistance to JP-4 aromatic fuel, 90% nitric acid, carboxyl compounds, aldehydes and type A transmission oil. Because of its high fluorine content (more than 60% by weight) it is nonflammable and resists combustion even when applied to flammable fabrics. It can be easily bonded to metals by standard curing methods, resulting in a rubber-to-metal bond strength of 50 psi.—**Minnesota Mining and Manufacturing Co., St. Paul. 112A**

Electrical Insulation

Blends of plastics fibers and resins to foster design of compact equipment.

A new class of flexible insulation materials for electrical equipment, providing high dielectric strength as well as mechanical strength, has been developed.

The new materials are combinations of compatible plastics fibers and plastics resins, produced by a papermaking process which assures a homogeneous blend. They carry the series designation of Duroid 2100.

The equal of other fibrous sheet insulating materials in mechanical strength, the new products are said to provide much higher dielectric strength per unit of thickness. This means that thinner, lighter insulation than previously feasible can be used to obtain desired levels of insulating performance. Less bulky insulation, in turn, contributes to more compact product design.

Another asset of the new materials is that they can be compounded of different types of fibers and resins, which makes possible insulation that is custom-tailored for the surroundings in which it will be used.

A grade already in production, Duroid 2100, is composed of acrylic fiber (Orlon) plus acrylic resin. It is primarily intended for hermetic applications where a main consideration is resistance to Freon-oil mixtures.—**Rogers Corp., Rogers, Conn. 112B**

Elastomer Spray

New mulch efficiently combats erosion and fosters seed germination.

A new elastomeric spray mulch, announced as the first sprayed elastomer to be used for its purpose, is reported to control soil erosion and speed seed germination with results far superior to any other current mulch product.

Called Vulcanol, the material is a nonflammable, nonirritating elastomeric polymer emulsion. It can be applied with standard spray equipment at temperatures as low as 45 F., and is said to be particularly good for graded areas and sloped terrains.

The substance forms a weblike, porous, water-insoluble coating on the soil, which does not penetrate but stays in place long enough for seed to germi-

Newsworthy Chemicals

Page Number is also Reader Service Code Number

Plastic coating fosters laboratory safety..... **110A**
Dihydroxyacetone now commercially available..... **110B**
New polyethylene for use in coatings..... **110C**
Fluorinated elastomer now has better workability..... **112A**
Plastics fibers, resins blended for insulation..... **112B**
Elastomeric spray used as mulch material..... **112C**
Polycarbonate resin shows versatility..... **114A**
Vinyl and styrene polymers as oriented fibers..... **114B**
Plastisol gives low-temperature flexibility..... **114C**
Three organic solvents available in very high purity.... **114D**
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He peeps at creep . . . to make plastic pipe last longer

Inside that large oven, many samples of USS National PVC Pipe are being tested for creep; that is, expansion or deformation. Samples are heated to 120F. or 135F. and stressed by internal water pressures from 200 to 900 psi.

Notice that extensometer strips are looped over each sample. The lab technician views these strips with a telescope to obtain the rate of expansion for each pipe sample.

National Tube conducts this creep test as well as stress-rupture tests to determine accurate working stresses for its polyvinyl chloride pipe. This is just another step that helps National Tube control the quality of its product.

USS National PVC Pipe handles acids, alkalies, salt solutions and alcohols. It's available in either high-impact or normal-impact, and it comes in sizes ½ inch to 12 inches in diameter. You may choose from Schedules A, 40, 80 and 120. For information, write National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pa. Ask for Bulletin No. 24.

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Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • United States Steel Export Company, New York

Polycarbonate Resin: Versatile New Thermoplastic

Having an unusual combination of functional engineering properties, polycarbonate resins are expected to make a strong bid for use in several major fields, particularly electrical and electronic equipment.

A polycarbonate trade-named Merlon is to be available in commercial quantities this spring. The material can be processed by any of the conventional methods for thermoplastics, and it requires no plasticizer. Typical products are shown above.

Notable properties of the new resin include high mechanical and dielectric strength, low water absorption, high heat stability, transparency and cold strength.—Mobay Chemical Co., Pittsburgh. 114A

nate. It is reported to actually accelerate the rate of seed germination. Because of its elastomeric qualities, it yields readily against wind and water on steep slopes without cracking. It will last for three to six months, as compared to one to three months for conventional mulches.—**Alco Oil & Chemical Corp., Philadelphia. 112C**

BRIEFS

Vinyl and styrene polymers in the form of highly oriented fibers are now available in developmental quantities. Designated VXKA-6112 and SXKA-0121, respectively, the fibrous resins appear to have applications in pulp and paper molding, specialty papers and laminates. They are also being evaluated as binders for nonwoven textiles. Fiber lengths vary from "very short" to ½ in.; diameters range from 2 to 200 microns. (See also p. 104.) — **Union Carbide Plastics Co., New York. 114B**

Plastisol, named Denflex Plastisol No. 9225, is reported to be suitable for molding of products which must be very wear-resistant and flexible at low temperatures, such as bellows, visors, dust covers, sleeves, hoods and grease boots. Products have a rubberlike feel, are resistant to gasoline and oils, and can be made by slush casting or hot dipping. — **Dennis Chemical Co., Inc., St. Louis. 114C**

Three solvents, acetone, trichloroethylene and methyl alcohol, are now available in very high purity for use in the electronics and other industries. Designated as Electronic Grade solvents, they are individually lot-analyzed. Among the specifications imposed is one keeping metal contaminants and boron to a maximum of 0.00001%.—**Fisher Scientific Co., Pittsburgh. 114D**

Metal oxides in micro-fine powder form, trademarked Micria, have been undergoing customer evaluation. The particles are so small that a row of 2.5 million would be only 1 in. long. (Corresponding particle size: about 100 Angstrom units.) They are expected to find markets in the ceramics, cosmetics, plastics, rubber, paint and metal industries.—**Monsanto Chemical Co., St. Louis. 114E**

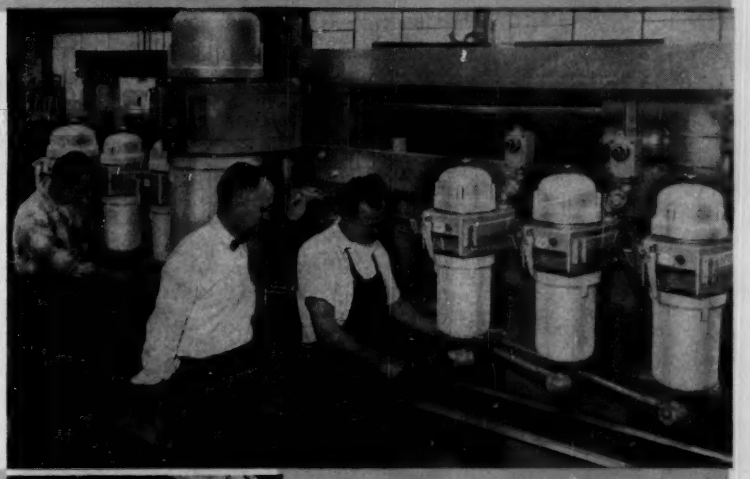
For More Information . . .
about any item in this department, circle its code number on the **Reader Service** postcard (p. 261)

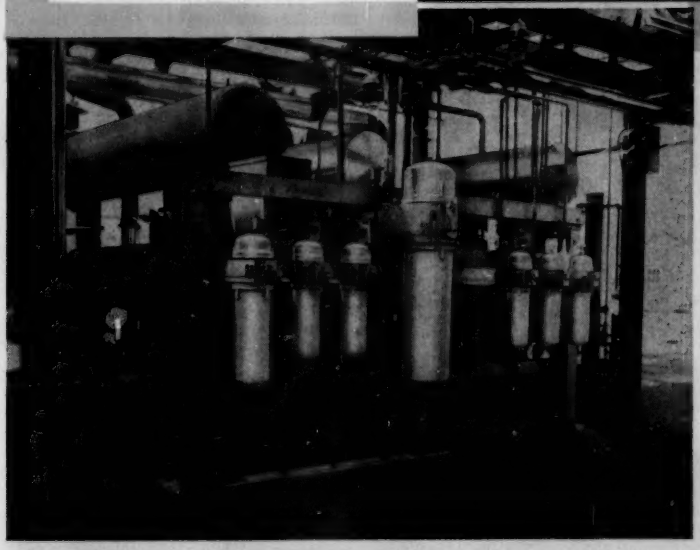
Another Reason for choosing Square D...

NEW RACKS FOR SPIN TOP® ENCLOSURES

FOR HAZARDOUS LOCATIONS

...you now can order Square D Spin Top enclosed starters completely wired and mounted on racks built to your specifications. Or, working through our field organization, we'll help you or your engineers design the rack. Either way, all the wiring and assembly work is done at the factory. Rack framework can be either bolted and hot-dipped galvanized or welded and painted.





INSTALLING your Spin Top rack on the job is a breeze. Just bring in the feeder connections to the bus bars, and make the outgoing power connections from starters to motors. It's as simple as that! Square D's exclusive "*slide* and hook" mounting arrangement greatly simplifies starter inspection and maintenance.

Spin Top enclosures are available in four sizes to include circuit breakers, across-the-line starters and combination starters, Size 0 through 5, reversing, non-reversing, and two-speed versions. They're built for Class I, Group C and D; and Class II, Group E, F, and G service.

***Write** for details. Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin*

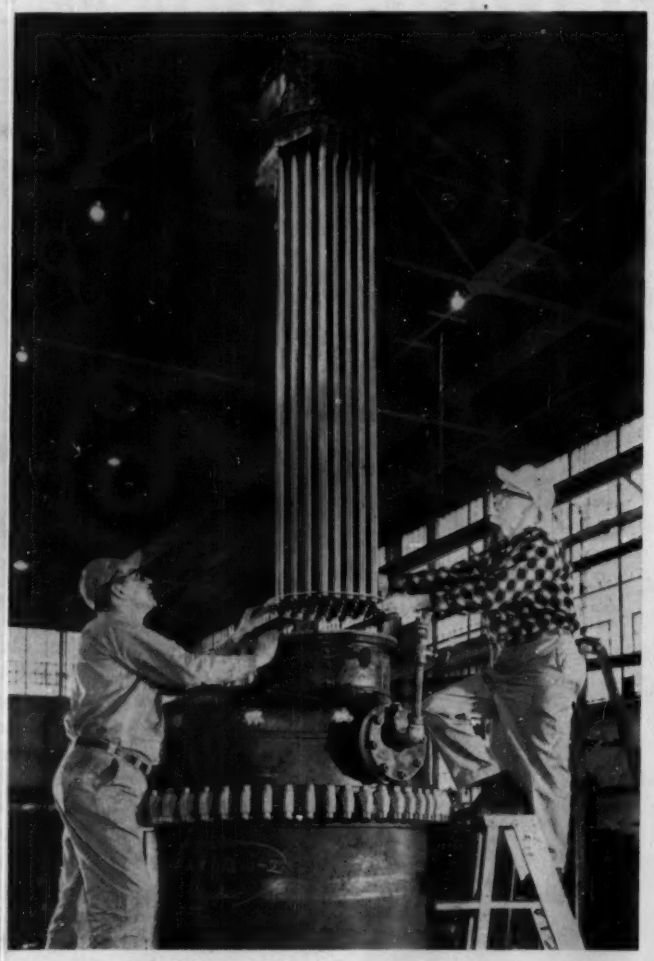
SQUARE D COMPANY

wherever electricity is distributed and controlled

DEVELOPMENTS . . .

PROCESS EQUIPMENT

EDITED BY C. S. CRONAN



Shop Tools Up to Make Bigger Tantalum Heaters

To broaden tantalum's contribution to corrosion-free equipment, Pfaudler has installed a vacuum-purge welding unit suitable for fabricating larger equipment than before. A product of this welder, the bayonet heater being lowered into glassed-steel nitric-acid reboiler (above) contains 52 tantalum tubes, 1¼-in. O.D. by 72-in. long totaling 124 sq. ft. Being corrosion resistant, tantalum tubes have 0.015-in. walls which transfer heat well, resist physical and thermal shock.—Pfaudler Co., Div. of Pfaudler Permutit, Inc., Rochester 3, N. Y. 116A

Electric Furnaces

Useful for metallizing, sintering R&D, production.

Compact research and production furnaces that provide uniform heat for applications requiring temperatures to 3,300 F. are now offered with automatic feed mechanism. Known as Type MY furnaces, these economical units feature molybdenum-wound elements, and can be used with a variety of nonoxidizing or inert atmospheres.

Among furnace features are: water-jacketed cooling sections; extended insulated throat areas that minimize thermal shock; and special arrangements that obviate atmosphere contamination.—**C. I. Hayes, Inc., Cranston, R. I. 116B**

Metering Pump

Pump capacity adjustable during operation.

After 2 yr. in development, the new Metriflow pump is available for a wide variety of metering applications involving the handling of slurries and viscous liquids. Distinguished by rugged but compact design, the pump is available in four standard sizes with capacities ranging from 0 to 54 gph., and for pressures to 300 psi. Duplex pumps that double these capacities without increasing motor size are also offered.

Gear case and pump body of the Metriflow are flanged together, completely sealing out moisture and dirt. There are no packing glands. All moving parts run in oil. Standard diaphragm is made of neoprene.

Discharge capacity of the

THERE IS A DIFFERENCE IN PIPE FITTINGS

Speedline®

CONTROLS WALL THICKNESS AT THE BEND

Long tangent elbows may *look* very much alike—but micrometers don't deceive. "Section" a Speedline elbow and compare it with any other. Then consider the difference Speedline *controlled wall thickness* can make in your critical process lines.

Controlled wall thickness means you get consistent fitting strength and effective corrosion resistance *all along the line.* Speedline forming equipment assures accurate control of wall thickness . . . at the bend in accordance with MSS-SP-43 specification. And you can count on Speedline quality control whether you specify Speedline fittings in stainless steel, aluminum, titanium, Hastelloy or other special corrosion-resistant alloys . . . including eccentric reducers and reducing tees and crosses.

Leading plants have proved there *is* a measurable difference in quality with Speedline fittings . . . the only complete line of long tangent fittings available from distributor stocks from coast to coast. Let a Speedline distributor prove the difference Speedline can make at your plant.

See pages 1513 to 1516 of the Chemical Engineering Catalog for Distributor listing. Complete catalog information available on request.

Out-Dated Forming Methods Reduce Wall Thickness as Much as 35% at the Bend.
Speedline's Controlled Wall Thickness is Measurable.

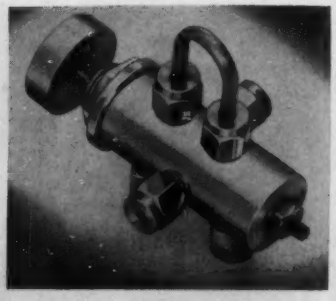
1004

Speedline®

CORROSION-RESISTANT FITTINGS

A PRODUCT OF HORACE T. POTTS COMPANY • 500 E. ERIE AVENUE, PHILADELPHIA 34, PA.

Metriflow adjusts via a control knob on top of the unit; the knob turns a lead screw to increase or decrease piston movement. An indicator shows pump capacity at all times. — **The Madden Corp., Chicago, Ill. 116C**



Sampling Valves

Inject gases into chromatography instruments.

A new series of compact, six-way gas sampling valves—guaranteed nonleak—is available for injection of precise volumes into any standard gas chromatography unit. Five models comprise the line: four panel-mount units and one heated-valve unit that allows injection of compounds with boiling points to 250 C.

Simple design assures long life and trouble-free operation. Spindles are fitted with silicone-rubber "O" rings for positive seal. Holdup volumes are less than 0.1 ml. Reproducibility is 0.1%. Prices vary from $60 to $120. — **Wilkens Instrument & Research, Inc., Walnut Creek, Calif. 118A**

Car Shakeout

Frees aggregates in hopper cars. Low cost.

Called the H-R Trackside, a new railroad car shakeout has been added to the line of manufacturer's material handling equipment. Mounted in a fixed position alongside the railroad track where hopper cars, either open or covered, are to be unloaded, the machine utilizes a hydraulic cylinder for unloading power. The cylinder exerts a force of 14 tons via a vibrating head placed against the side of the car. The head shakes the entire car and causes compacted or frozen material to loosen and flow through the hoppers.

H-R Trackside is designed to meet the needs of operations requiring unloading of 1 to 10 hopper cars per day of aggregates. Vibrator motor is 7½ hp.; pump drive is 3 hp.—**Hewitt-Robins, Inc., Stamford, Conn. 118B**

Fitting Insulation

Molded product contours to surface of fittings.

Fit-Rite, a molded glass-fiber insulation for standard pipe fittings comes in ½- through 2-in. thicknesses and standard sizes for welded and cast ells, tees, and upon request, for special shapes.

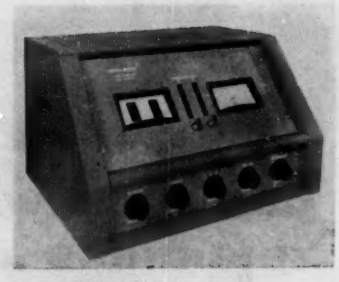
Each fitting consists of two accurately molded halves that fit together instantly. It installs quickly with staples, soft wire or tape. Once in place, it can be finished with canvas or vapor bearing casings.—**Fibrous Glass Products, Inc., Hicksville, N. Y. 118C**

For More Information . . .

about any item in this department, circle its code number on the

Reader Service

postcard (p. 261)

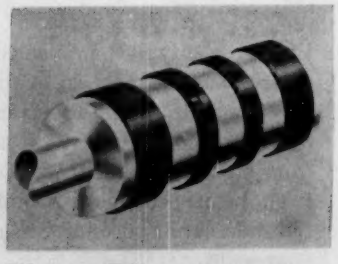


Gas Monitor

Keeps tabs on CO_2 content of gas streams.

Industrial Instruments Engineering Corp. has announced the availability of a new gas-stream monitor for continuous indication and control of carbon dioxide concentrations under 2% in nitrogen gas streams.

Utilizing a thermal conductivity sensing detector, with sensing cell immersed in a temperature-controlled oil bath, the device is claimed to be accurate to better than ±0.05% CO_2. A transistor-regulated power supply precisely controls the bridge's current. An alarm point that operates if concentration exceeds preset limit is optional. — **Industrial Instruments Engineering Corp., Cedar Grove, N. J. 118D**



Piston Rings

Carbon-filled fluorocarbon is construction material.

Ideal for nonlubricated service, piston rings made of filled Teflon resin are available for the temperature range from —420 to 500 F. Typical applications include sealing of reciprocating, oscillating and rotary motion for both external and internal cylindrical surfaces

Hats off to the can that flips its lid—

CONTINENTAL'S NEW FLIP CAP*

For beauty, economy and convenience, Continental's new Flip Cap* can't be topped. Its dripless pour spout—plus the permanently hinged Flip Cap—makes it perfect for practically all liquids and granulated products now packaged in round or oblong nozzle-type cans.

Snap back Flip Cap and it *stays open*...snap it shut and it *stays shut*. The larger can opening permits higher filling speeds. Flip Cap nozzle inserted after filling assures positive closure. And the top of the container can be fully lithographed—no solder splashes, no flux spots or heat scorching. Flip Cap is available with either ½- or ¾-inch opening, and in a variety of colors. For the full story, ASK THE MAN FROM CONTINENTAL!

*Patents pending

METAL CANS SERVING MAN FOR 150 YEARS • 1810 1960

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Canadian Division: 790 Bay St., Toronto 1
Cuban Office: Apartado 1709, Havana, Cuba

A Big Year for Sodium Borohydride

New Price, Product Forms, Applications!

The pace of progress has been rapid! If you're not up to date on sodium borohydride's growing role in chemical processing, you'll profit from this review.

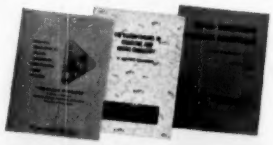
New price! $19.90 per pound is the new domestic price for 98% pure sodium borohydride powder in lots of 5,000 pounds. Increased commercial use and expanded production have made this possible.

New product forms! (1) PELLETS—Sodium borohydride is now available in smooth, crowned pellets that simplify handling. Available in both 10/32" and 24/32" diameters. (2) SWS — Stabilized water solution, a new form of sodium borohydride is available in commercial quantities at a price less than half of the pure powder material. A stable, aqueous caustic solution, sodium borohydride content is about 12 weight per cent. (3) PURE POWDER — 98% sodium borohydride, a white crystalline product, remarkably stable and easily used with complete safety in standard equipment.

New applications — New product forms have sparked many new applications. Pellets, for example, make sodium borohydride ideal for continuous fixed-bed, in-stream carbonyl group and peroxide reductions. SWS will perform the same reductions using simple contact methods. Sodium borohydride is exceptionally effective for foaming plastics and silicates; bleaching and stabilizing wood pulps; and treating natural and synthetic textiles. In any form, it offers many advantages as a high-yield reducing agent for esters, aldehydes, ketones, and peroxides.

For technical service — Contact MHI! Over 23 years experience, plus exclusive patent rights for the manufacture of sodium borohydride and its organic reduction applications, qualify MHI as an exceptionally helpful source for technical service.

For complete information, write for these technical publications.



The Mixed Hydrides Organic Reductions | $NaBH_4$ in Cellulose and Sugar Chemistry | $NaBH_4$–KBH_4 Manual Properties—Reactions

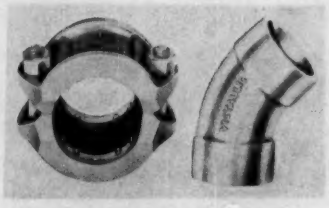
PIONEERS IN HYDRIDE CHEMISTRY

Metal Hydrides Incorporated

418 W. CONGRESS STREET, BEVERLY, MASSACHUSETTS

against the leakage of liquids or gases.

Mechanical strength and dimensional stability are excellent, according to the manufacturer. The rings are tough, abrasion-resistant, and have the ability to imbed hard foreign particles without adversely affecting cylinder life or that of the ring itself. Designs offered include butt joint, step joint, scarf cut or solid design. Matched filled Teflon rider rings are also made for long-stroke service.—**Garlock Packing Co., Palmyra, N. Y.** 118E



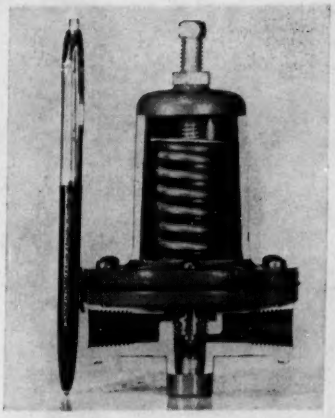
Pipe Connector

New piping system is simple, low-cost, leaktight.

Many engineering and cost-reducing advantages are claimed by the manufacturer for the new Plainlock method of pipe connection. The method utilizes new-design couplings and fittings with plain- or beveled-end pipe.

Designed with two bolts for quick installation, Plainlock couplings are fitted with hardened stainless-steel grips that engage pipe ends and securely lock them together. An ordinary wrench with normal torque is sufficient to seat the grips in the pipe or fitting ends to complete the coupling.

Plainlock fittings, provided as part of the Plainlock package, have long-radii "Full-Flow" sweeps for good hydraulics and minimum friction loss. Ample wall thickness provides for protection against corrosion and abrasion. Fittings come with plain ends or in combination of plain, grooved, threaded or flanged ends for interconnection with other piping systems. Sizes range from 1 to 6 in.—**Victaulic Co. of America, Elizabeth, N. J.** 121A

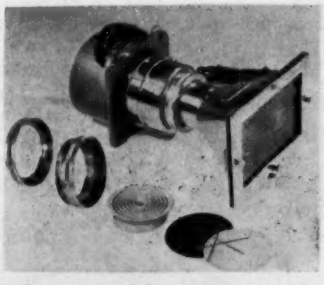


Instrument Regulator

Versatile device controls instrument-air pressure.

Applications for the new "080" instrument regulator can vary from control of inlet pressures on sensitive regulating and recording devices to a first-stage regulator for LPG systems. Extremely versatile, the instrument will fit into any operation where a controlled supply of air or other gas pressure is required.

Constructed of pressure die-cast aluminum, the "080" has a maximum inlet pressure of 250 psi., and outlet pressure ranges of 0-5, 5-35 and 35-100 psi. Optional construction features a handwheel adjustment and a ¼-in. side outlet tap for pressure-gage mounting.—**Rockwell Mfg. Co., Pittsburgh, Pa.** 121B

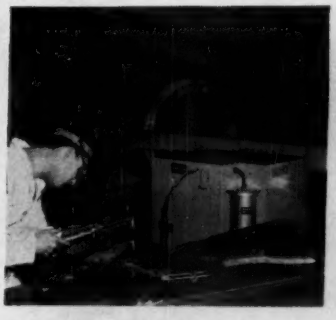


Filter Holders

Adaptors expedite entire air-sampling operation.

Staplex Co. has announced the availability of filter holder adapters, ranging in sizes from 6x9 to 12x12 in., for its portable high-volume air sampler. This innovation will enable the machine to collect large samples of air being tested in a much shorter time.

Utilizing a turbine-type roller, the unit is able to collect particulate matter as small as 1/100th micron in diameter, both indoors and out. Typical applications with the new adapter include measurement of smoke and smog, occupational dusts and radioactive particles.—**The Staplex Co., Brooklyn, N. Y.** 121C



Oxygen Source

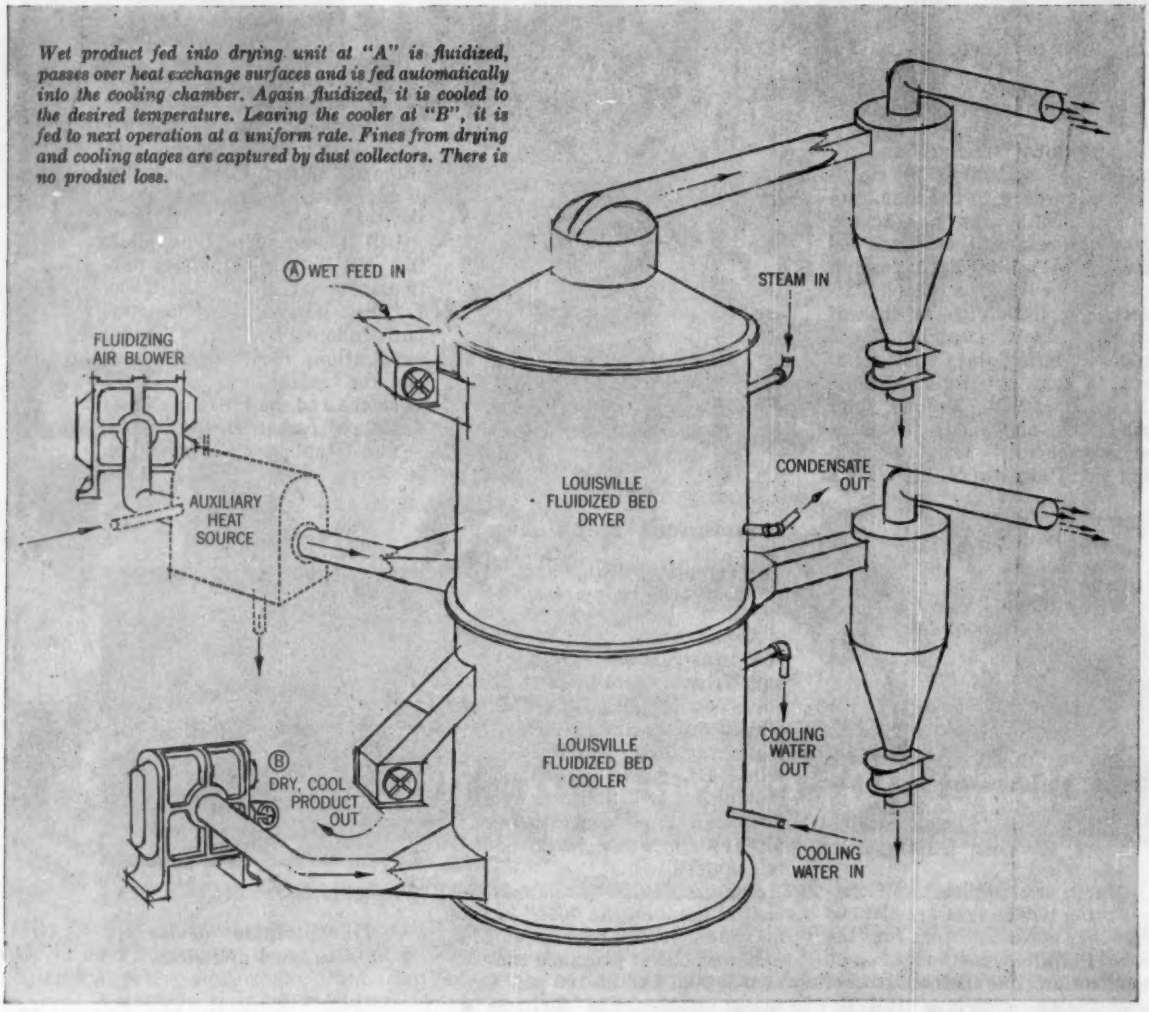
Transportable device replaces steel cylinders.

Aerojet-General is offering a new, transportable oxygen unit that produces an unlimited supply of oxygen from the atmosphere at approximately 5 psig. in less than 1 min. after connection to any 110-v. electrical outlet. Details of operation have not been described beyond the point that the unit "draws air from the atmosphere, filters out the contaminance, extracts oxygen and delivers the gas."

Required floor space for the present model is about 2 ft. sq.; weight is 150 lb. According to Aerojet, however, flexible internal design permits fabrication to almost any shape and size. Primary industrial use is

EQUIPMENT NEWS Continues on . . . Page 236

Wet product fed into drying unit at "A" is fluidized, passes over heat exchange surfaces and is fed automatically into the cooling chamber. Again fluidized, it is cooled to the desired temperature. Leaving the cooler at "B", it is fed to next operation at a uniform rate. Fines from drying and cooling stages are captured by dust collectors. There is no product loss.



Major break-through in drying and cooling techniques announced by

GENERAL AMERICAN

A new system for drying and cooling has been perfected by General American Transportation Corporation through their development of Louisville Fluidized Bed* equipment. Two Louisville units, one functioning as a dryer and one as a cooler are coupled vertically to provide a continuous automatic operation.

The system is particularly useful for crystalline chemicals, resins, polyvinyl acetate beads, polyethylene pellets, sugar and similar products having the proper particle size distribution.

Louisville Fluidized Bed equipment offers these advantages:

1. Accurate, instantaneous temperature control
2. High heat transfer that permits compact design
3. Low maintenance costs (no moving parts)
4. Less cleaning time and labor
5. Less floor space (equipment is vertical)
6. No hot spots (product is fully protected)

Because of their simplicity, Louisville Fluidized Bed dryers and coolers adapt readily to complete automation.

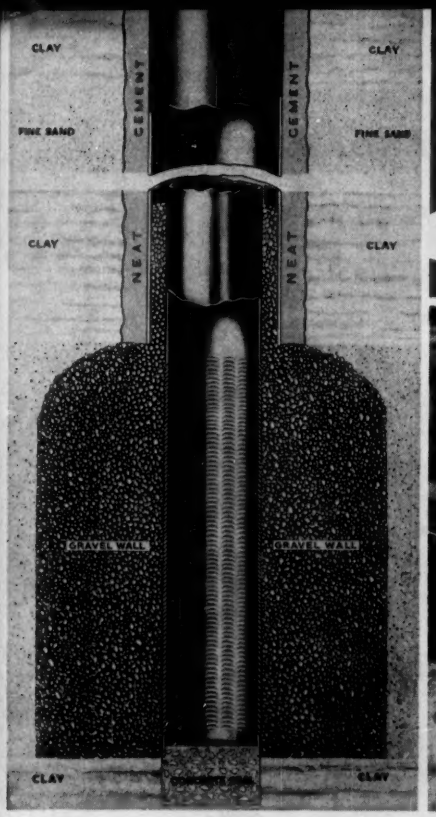
For full details about this revolutionary development in drying techniques, write Dept. F.

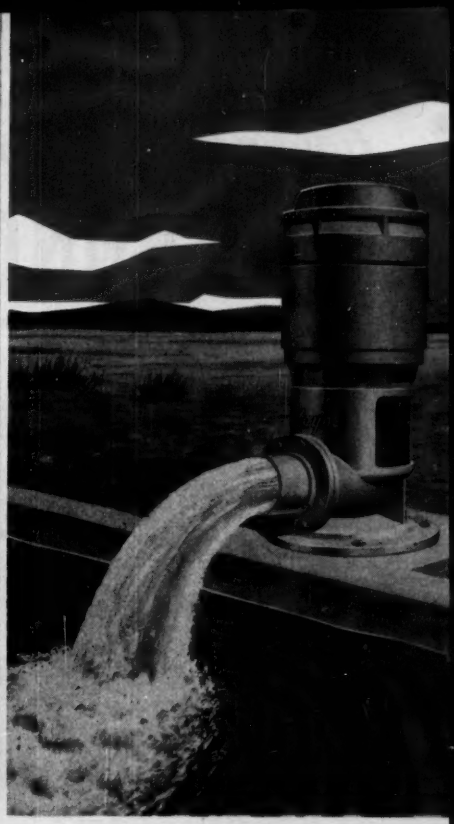
Process Equipment Division

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South LaSalle Street
Chicago 3, Illinois
Offices in principal cities

*Patents Pending





WATER WATER WATER

With A Layne Drilled Well Layne knows where the water-bearing formations are located. They have been drilling wells for over 75 years. This experience comes from searching and researching water aquifers. Knowing *where* to drill is half of the success—knowing *how* is the other half. In drilling a straight well experience counts—and you can count on Layne. Layne specializes in water well drilling. To get a good start for a water supply—you need a good well. You get a good, producing well when you specify a Layne drilled well. *Bulletin No. 100*

With A Layne Gravel Wall Well This technique and resulting arrangement of the new 134 Shutter Screen and gravel (shown here) permits the free flow of water into the well and affords the following advantages: larger shutter screen openings, reduced friction, reduced draw down and pumping head—thereby reducing pumping costs, increased specific capacity and more effective retention of native sands. Cemented wells are installed if indicated, and result in greater purity of supply as well as increased life of the well. *Bulletin No. 900*

With A Layne Vertical Turbine Pump Whatever the pumping requirement, there's a Layne pump to meet any pumping conditions. Layne Vertical Turbine Pumps come in a wide range of sizes and capacities, delivering 30 to 20,000 GPM and requiring from 4 to 42 inch well casings. The complete line of Layne Pumps include: Deep Well Vertical Turbine (oil or water lubricated), Short Coupled Vertical Turbine, Propeller, Mixed Flow, Fire Pumps and Volatile Liquids Pumps, Regular and "In-Line" Submersible. *Bulletins No. 200 (oil) 201 (water)*

LAYNE OFFERS COMPLETE WATER SERVICE: Initial surveys • explorations • recommendations • site selection foundation and soil-sampling • well drilling • well casing and screen • pump design, manufacture and installation construction of water systems • maintenance and service • chemical treatment of water wells • water treatment—all backed by Layne Research. Layne services do not replace, but coordinate with the services of consulting, plant and city engineers.

Layne SINCE 1882 — WORLD'S LARGEST WATER DEVELOPERS

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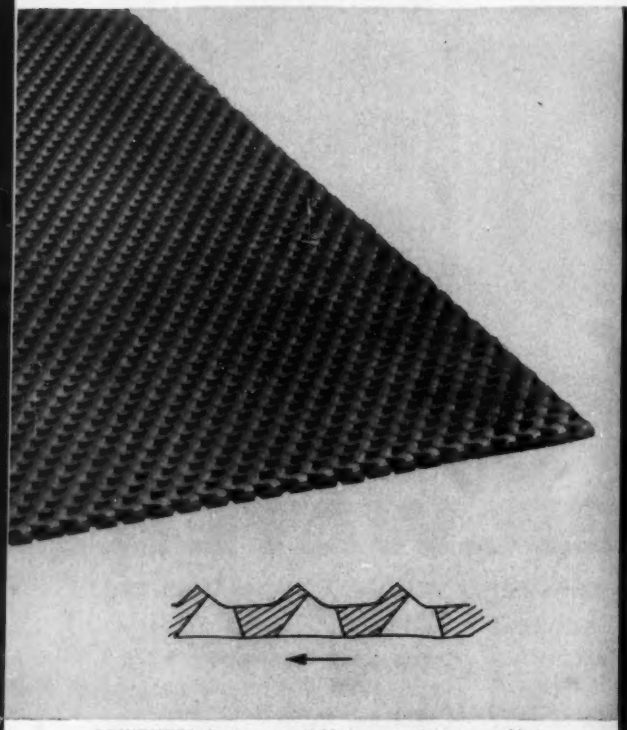
LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

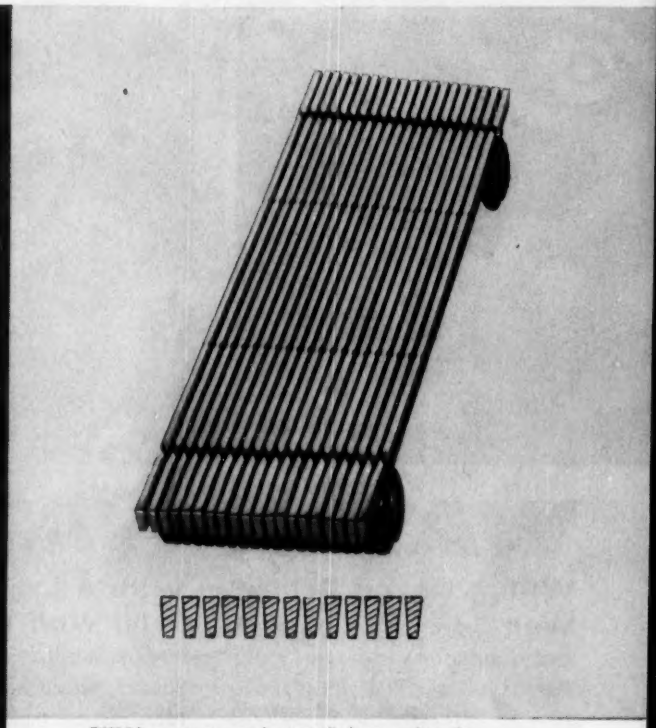
Sales Representatives in Major Cities

from **NATIONAL-STANDARD**

NEW CONCEPT IN SCREENING



CONIDURE* sheets are available in a complete range of hole sizes and rolled surfaces. The working side of Conidure sheets has shovel-like humps that guide material into the narrow openings, increasing screening action. The extreme taper of the hole prevents clogging or blinding.



RIMA* screens can be supplied as rectangular, oblique angled, round or oval beds. The complete range of slit widths and wire profiles accommodates a wide variety of screening and filtering operations.

New **CONIDURE** *Screens*

New Conidure sheets are produced by a unique process of piercing trapezoidal-shaped holes, highly tapered in the screening direction. Sheet thickness can be several times greater than hole diameter for higher capacity and longer wearing life in coal, sugar and chemical centrifuges or on vibrators, separators and screening machines.

*®by Hein, Lehmann & Co., Dusseldorf, Germany

New **RIMA** *Screens*

New Rima shaped-wire screens for coal, paper and food processing and water or sewage filtration have special capacity advantages over standard wedge-wire screens because of high-narrow profile wires that provide larger open area. The unique cross bar and spacing lugs keep wires uniformly separated for greater efficiency in screening.

FOR COMPLETE INFORMATION on New Conidure and Rima Screens, write for new illustrated catalog to NATIONAL-STANDARD COMPANY, NILES, MICHIGAN

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NS NATIONAL-STANDARD COMPANY

Cross Perforated Metals

NATIONAL-STANDARD COMPANY

Carbondale, Pa.

ALEMITE
BARREL-TO-BEARING
LUBRICATION

the "moving force" of production!

More and more, cost-conscious plant men are recognizing modern lubrication as an important "production tool." No longer do they see it as a simple maintenance problem.

With the years-ahead Alemite Barrel-to-Bearing Lubrication method, today's leading manufacturers are stepping up production . . . reducing downtime . . . extending machine life.

Included in a complete Alemite barrel-to-bearing lubrication method can be electric, air or hand-operated equipment. It will more than meet every need for high-pressure lubrication, filling hydraulic systems, servicing oil reservoirs, lubricating gear housings, and refilling grease guns.

Write for free Alemite catalog today!

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STEWART-WARNER CORPORATION

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Cover protects 400 lb. drum

Air operated transfer pump Model 7216-A is added

Powergun rolls wherever needed

GREATER EFFICIENCY

for Industrial Heating at
ELEVATED TEMPERATURES...

The HI-TURBIANT HEATER

by Western Precipitation

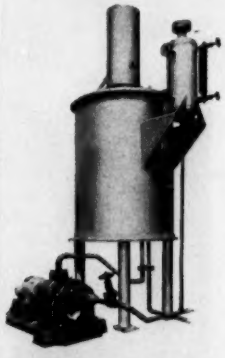
Backed by the application "know-how" and process equipment experience of Western Precipitation, the Hi-Turbiant Heater system fills a growing need in modern chemical processing operations—a means of heating high-temperature heat-transfer fluids such as Dowtherm, Aroclor, hydrocarbon oils and similar heat-sensitive fluids. It is also ideal for other applications — steam superheating, Rich-Oil denuding, asphalt heating and processes where fluids must be heated under close thermal control.

Pictured above is a 3.0 MM BTU/Hr. Aroclor Heater for use in an engineered high temperature heating system fabricated for a leading Chemical producer. The entire system was engineered in consultation at the purchaser's plant by the same Staff Engineer who will continue to provide prompt on-the-spot technical service.

Hi-Turbiant Heaters are unique in that ALL FLUIDS WITHIN THE SETTING ARE SUBJECT TO PROMOTED TURBULENCE. The process fluid is maintained at high Reynolds Number by specially designed pumps, and the products of combustion are maintained at turbulent velocities by the use of a special re-radiating baffle.

Relating baffle design to tube spacing and wall clearance permits a substantial increase in Heater length to diameter ratio while maintaining optimum average flux rate over the entire tube length.

The re-radiating Metallic Baffle is spray coated with refractory material originally developed for the high temperature and erosive conditions encountered in rocket engine combustion chambers.



An 800,000 BTU/Hr. Heating System, completely piped and wired for your pilot plant studies, is available on a loan basis. The test Heater is gas fired, with combustion safeguard and controls.

COTTRELL Electrical Precipitators
MULTICLONE Mechanical Collectors
CMP Combination Units
DUALAIRE Jet-Cleaned Filters
THERM-O-FLEX Hi-Temp Filters
TURBULAIRE-DOYLE Scrubbers
HOLO-FLITE Processors
HI-TURBIANT Heaters

WESTERN
PRECIPITATION
DIVISION OF JOY MANUFACTURING COMPANY

Engineers and Constructors of Equipment for Collection of Suspended Material from Gases . . . and Equipment for the Process Industries

LOS ANGELES 54 • NEW YORK 17 • CHICAGO 2 • PITTSBURGH 22 • ATLANTA 5 • SAN FRANCISCO 4

Representatives in all principal cities

Precipitation Company of Canada Ltd., 8285 Mountain Sights Avenue, Montreal 9

Photo shows portable pump unit connected to internal combustion engine by a Type F FALK Steelflex Coupling

How FALK STEELFLEX Couplings give your connected machinery Double Protection

FIRST: *They protect against shaft misalignment.* Some degree of shaft misalignment is unavoidable—and unless protective compensation is provided, additional loads are developed on shafts, bearings and other revolving elements. The result is excessive wear-and-tear—and often actual breakage....FALK Steelflex Couplings compensate for either angular or parallel misalignment—*or for the more serious condition involving both!* The exclusive Steelflex gridmember which joins the two hubs is not fastened to either hub; thus, either hub can shift in any direction without imposing a load on the other hub.

Yet, important as protection against shaft misalignment is to you, it is only one function of the *truly flexible* FALK Steelflex Coupling.

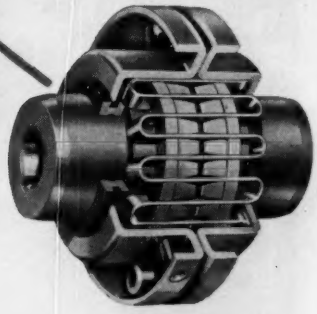
SECOND: *They protect against torque fluctuations* which create excess wear on connected machines and frequently induce destructive shaft misalignment. The exclusive FALK Steelflex grid-groove design cushions shock loads, dampens vibration, reduces impact loads as much as 30 per cent. You get this extra margin of protection that *can mean the difference between operating and breakdown!* You save on maintenance costs. And —you prolong the service life of your machines!...For complete information, ask your FALK Representative or Authorized Distributor. Or—**write direct for Bulletin 4100.**

FALK and STEELFLEX are Registered Trademarks

THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN

Representatives and Distributors in Most Principal Cities

Manufacturers of Quality Gear Drives and Flexible Shaft Couplings



Basic Type F FALK STEELFLEX COUPLING fills the needs of 90% of industrial applications

This cutaway view shows the exclusive Steelflex design which provides *torsional resilience with the strength of steel.* This torsional resilience spreads peak or shock loads over a relatively long increment of time, thus *greatly reducing stresses* in connected machinery.

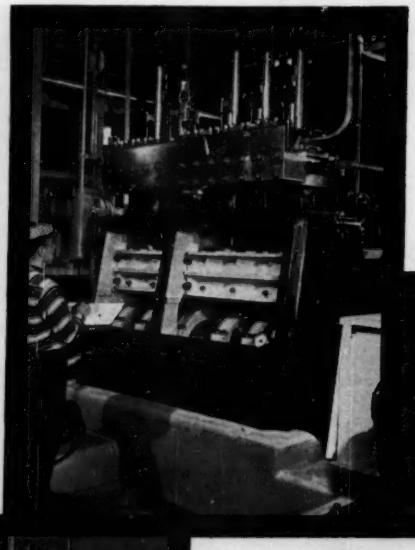
The versatile Type F Steelflex can be used horizontally or vertically, without modification or special parts. It is ideally suited to 9 out of 10 applications. For unusual applications involving overload conditions, extended shafts, brakes, etc., standard designs of dual-purpose Steelflex couplings are available.

For most applications, you can give your machines the extra protection afforded by FALK Steelflex Couplings at no extra cost!

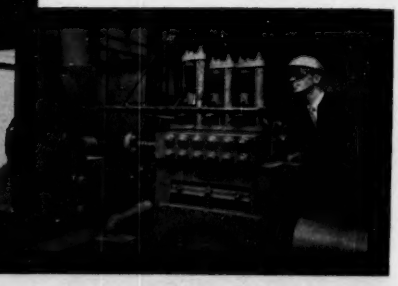
FALK

...a good name in industry

WHAT'S YOUR SPECIAL PROBLEM IN PUMPING?

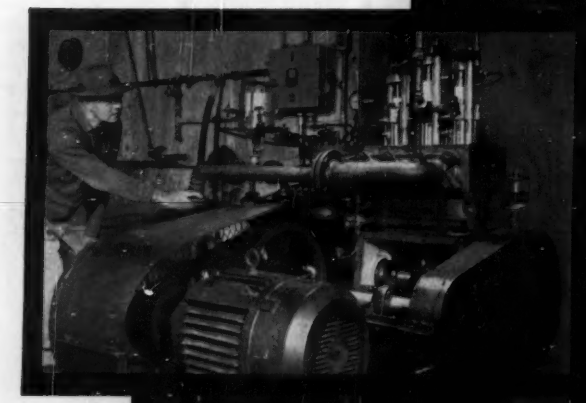


Special nylon ball valve and stainless steel fluid end handle silica gel at 1800 psi.

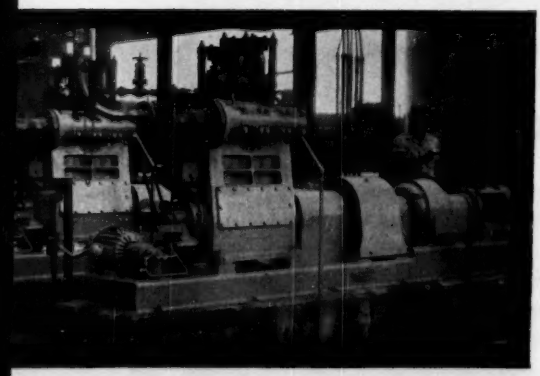


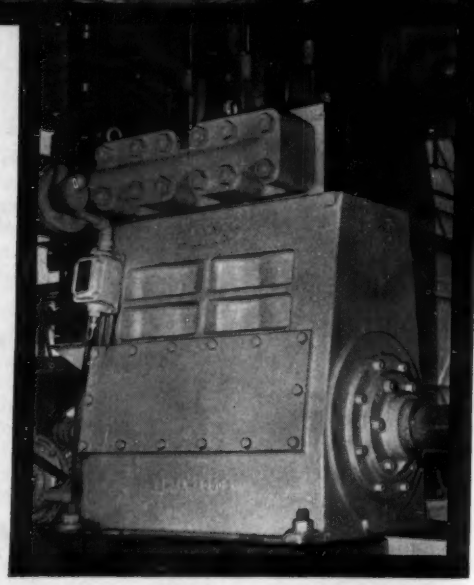
This Aldrich pump handles highly corrosive chemicals—both alkaline and acidic.

Here, Aldrich pumps continuously control the flow of liquid ammonia at 3700 psi.



Aldrich pumps with nickel alloy fluid end pump 50% caustic soda solution at 400 psi.



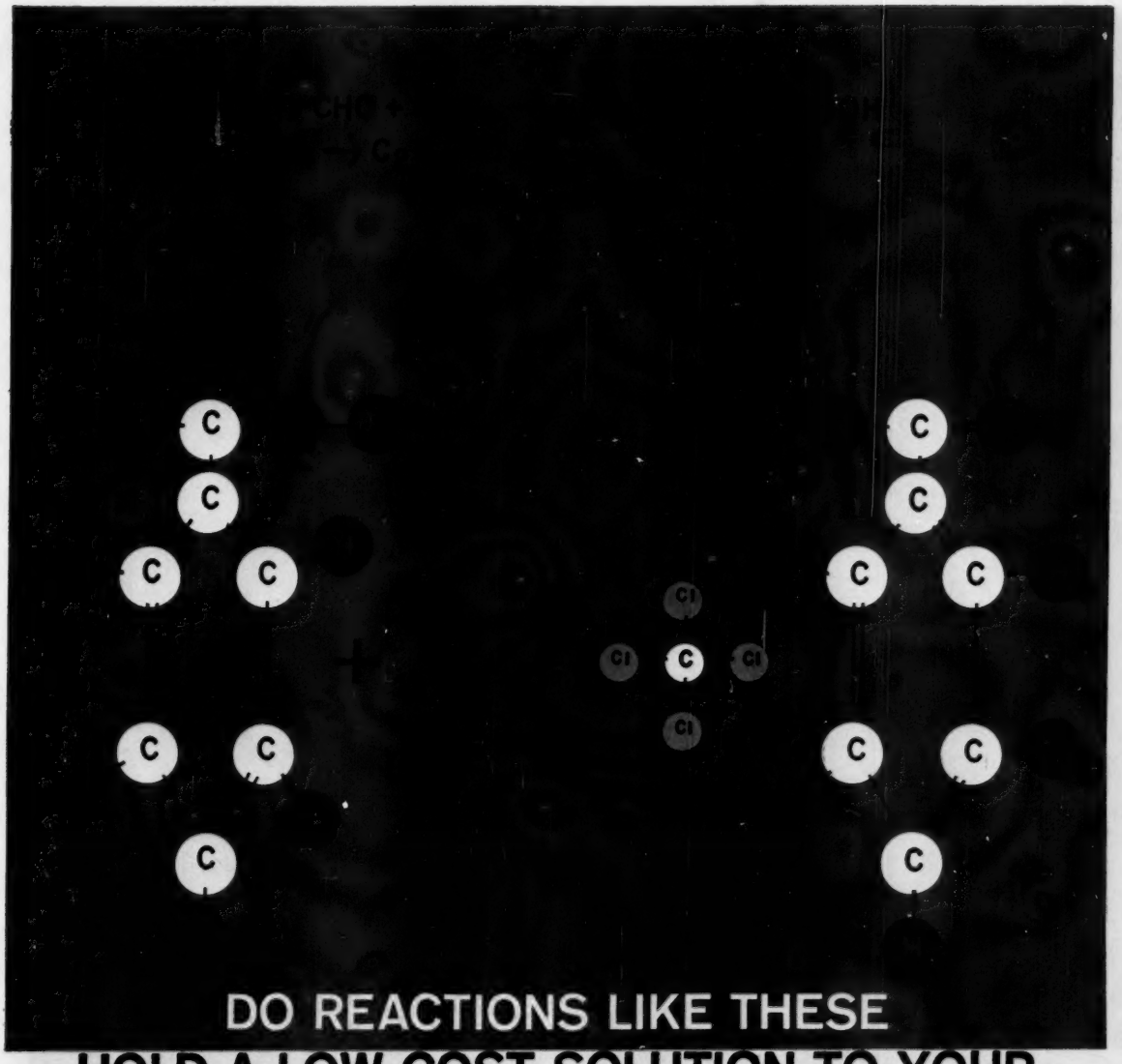


To handle, alternately, caustic and brine, at 3000 psi, this Aldrich Triplex pump has entire fluid end of Monel.

Corrosives? Slurries? High pressures? High temperatures? We'll find the answer!

All pump companies sell pumps. And all have their share of pumping problems. At Aldrich, our most important stock in trade is our ability to solve the rough pumping problems of the process industries. We've had over 50 years of working with chemicals and chemical processes. We know the problems of pump wear; of temperature, corrosion, viscosity; and your need for sustained pump operation. We study all the factors in your problem, in depth . . . and come up with a *better* answer, not merely *an* answer. For information on capacities, pressures and sizes, see our insert in *Chemical Engineering Catalog* or write for reprint (Data Sheet 100). ALDRICH PUMP COMPANY, 3 Gordon Street, Allentown, Penna.

The tough pumping problems go to ALDRICH



DO REACTIONS LIKE THESE

HOLD A LOW COST SOLUTION TO YOUR OXIDATION PROBLEMS?

Allied Chemical Nitrogen Tetroxide is a low-cost oxidant. It can be used in the wood pulping, rubber, metal recovery, and lubricant purification industries, and for many other applications. Perhaps this versatile chemical can solve some of *your* oxidation problems.

See the box at right for further reactions. For further information and application data on Allied Chemical Nitrogen Tetroxide, write for Allied Chemical's 59 page product bulletin "Nitrogen Tetroxide".

Allied Chemical's Nitrogen Tetroxide is shipped in tank-cars, one-ton cylinders, or 125 and 150 pound cylinders.

NITROGEN TETROXIDE CAN BE USED AS A LOW COST OXIDIZER:

- ... At very low temperatures in the form of solutions, such as NO in N_2O_4
- ... In concentrated liquid form from −11° to 21°C
- ... In acids such as sulfuric and nitric
- ... As a gas in form of NO_2 at elevated temperatures
- ... As a solution in carbon tetrachloride or chloroform from 0° to 30°C for such oxidation reactions as
  - Aromatic alcohols to aromatic aldehydes;
  - Alkyl aryl carbinols to ketones;
  - Alcohol groups in starch or cellulose to carboxyl groups;
  - Thiols to sulfonic acid.

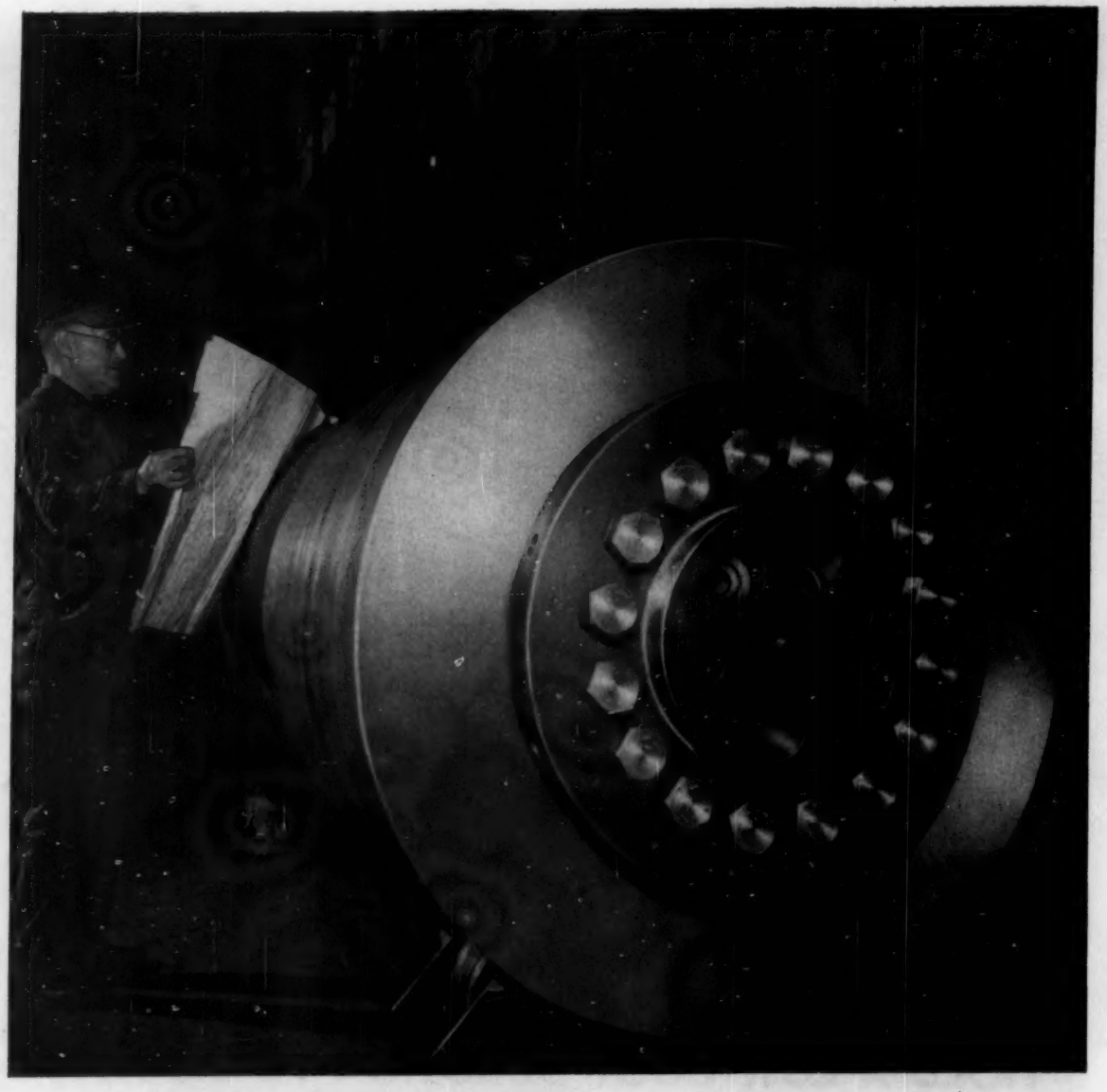
For specifications and local offices, see our insert in Chemical Materials Catalog, pages 475 - 482 and in Chemical Week Buyers Guide, pages 37 - 44.

BASIC TO AMERICA'S PROGRESS

2819

NITROGEN DIVISION

Dept. NT13-5-3, 40 Rector Street, New York 6, N. Y.



Big, Strong, and Ready for Work

This bulldog of a pressure vessel looks rugged enough to accept any challenge that may come its way. It certainly won't be bothered by the pressures it will handle on the job, for its massive walls are 11 in. thick. All told, there are 39 tons of steel in its 20-ft body.

Making forged pressure vessels has been a Bethlehem specialty for many years. The one shown here is typical. It could be called a middleweight—not nearly so large as some that come out of the Bethlehem shops, but no pygmy, at that. Bethlehem builds vessels in a full range of sizes, each being a custom job with specifications minutely followed.

Our integrated service makes it possible to supply the steel, do all necessary forging, heat-treating and machining, then assemble the vessels into their final form. They're ready for work when the customer receives them.

So, when you require forged vessels for service in the chemical, rubber, petroleum, fertilizer, food-processing or allied industries, we suggest you call us. Our engineers will gladly offer suggestions that may be of assistance in the planning of autoclaves, filters, reactors, converters, separators, or high-pressure accumulators.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.
Export Distributor:
Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

ALL sizes
from 1 sq. ft. to 1000 sq. ft. filtering area.
ALL styles
flush plates & frames • recessed plates • hollow plates • solid center plates • retaining ring, packing ring & grooved joint plates.
ALL materials
cast-iron • aluminum • bronze • lead • nickel • rubber • stainless steel • wood • glass reinforced resins, etc
Performance PROVED throughout ALL industries
SPERRY

in ALL ways...the simplest, most economical means of superior filtration!

Recognizing that no single type filter press will satisfy all requirements, Sperry makes available the broadest combinations of design features to help you achieve maximum efficiency and economy.

Briefly—the Sperry Filter Press can be equipped with any type of plates—made of virtually any material—to handle any filterable mixtures—and most filter media—over a wide range of temperatures, pressures and capacities—with center, side or corner feed—open or closed delivery—for filtration of liquids, recovery of solids, clarification and decolorizing.

Sperry also manufactures a complete range of plate shifting and closing devices—enabling one man to control the entire operation.

All this—at low first cost, low depreciation and minimum maintenance! Write for details or mail coupon for free Sperry catalog.

D. R. SPERRY & CO., Batavia, Ill.

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808 Nepperhan Ave.
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Alldredge & McCabe
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Texas Chemical Eng. Co.
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The Gilbert Tramer Co.
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☐ Send Free Sperry Catalog
☐ Have your Representative Contact us

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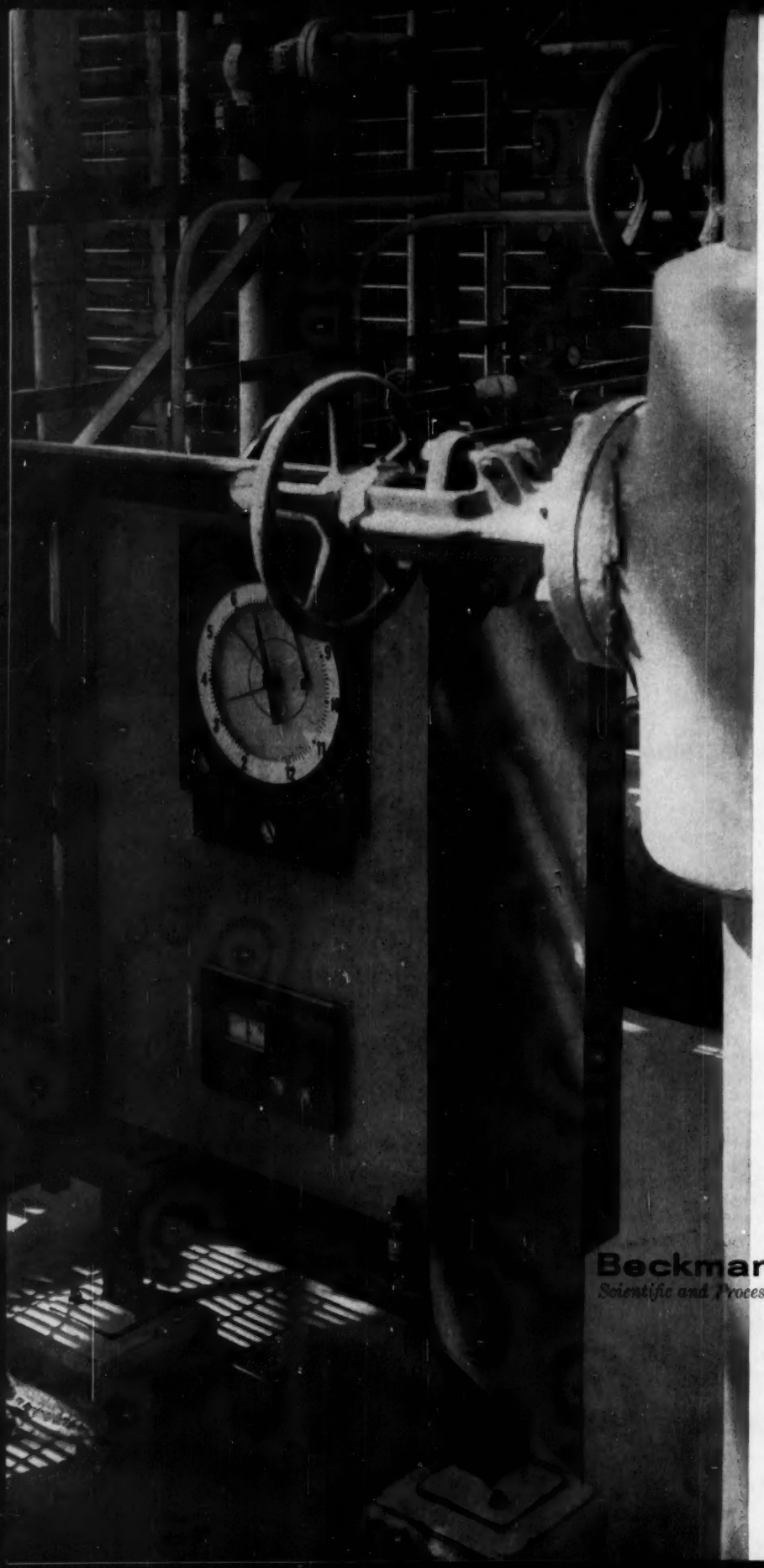


4 minutes' attention for 24-hour operation

Just 4 minutes a day and a Beckman Model W Industrial pH meter are all it takes for a technician to prevent equipment corrosion by continuous pH control of cooling tower water at Collier Carbon and Chemical Corporation, Brea, California.

For over two years, this small Beckman pH amplifier has continuously maintained cooling water at a pH of 6, correcting all variations automatically in about 15 seconds. And, except for the few minutes attention required every morning for routine meter standardization, it has provided maintenance-free operation.

Beckman pH equipment can also give *you* dependability with minimum attention. The reason: printed circuitry, plug-in assemblies, and ruggedized industrial electrodes

Beckman makes and sells more industrial pH equipment than any other manufacturer in the world. Equipment and services are provided by leading recorder companies. For a list of these companies and instrument specifications, write for Data File 14-17-03.

Beckman
Scientific and Process Instruments Division
Beckman Instruments, Inc.
2500 Fullerton Road, Fullerton, California

INSTRUMENTAL IN YOUR FUTURE 25 YEARS 1935-1960

It's a Fact: More than 500,000,000 hours have been logged by Beckman industrial pH meters...measuring and controlling pH in industrial processes.

News from
National Carbon Company
Division of Union Carbide Corporation • 30 East 42nd Street, New York 17, N. Y.
Sales Offices: Birmingham, Chicago, Houston, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco. IN CANADA: Union Carbide Canada Limited, Toronto

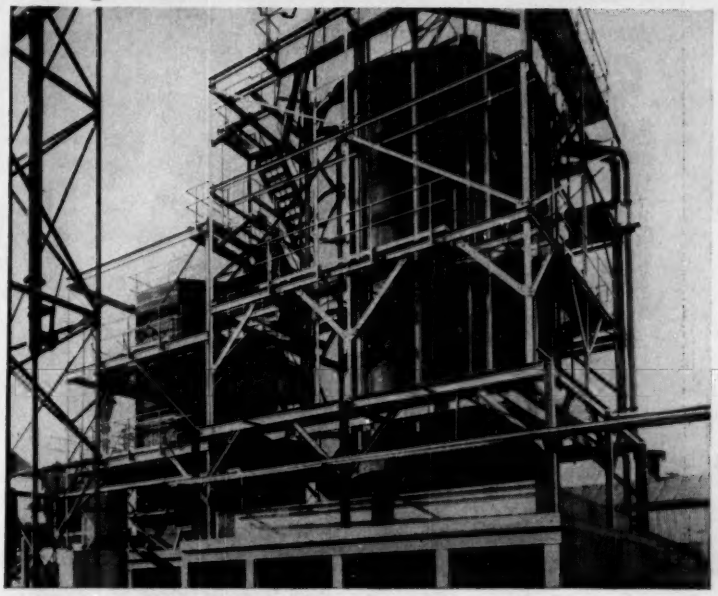
Manager, Process Equipment Sales

J. F. Revilock

Mr. Revilock was graduated from Case Institute of Technology with a B.S. in Chemical Engineering. For two years he worked at a mid-west research center, designing and installing chemical process equipment for pilot plant production of special aircraft fuels and lubricants.

Mr. Revilock joined National Carbon Company in 1944. For three years he worked in the Sales Department Development Laboratory designing and testing new "Karbate" impervious graphite products and improving existing equipment. For the past eleven years, he has been actively engaged in the design, construction, installation and process application of carbon, graphite and "Karbate" impervious graphite equipment. In 1954, he was appointed Manager of Process Equipment Sales, Chemical Products Marketing.

NATIONAL CARBON Makes the World's Largest Diameter Graphite Combustion Chamber



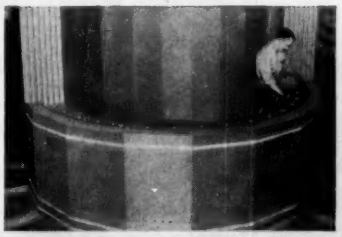
World's largest diameter graphite combustion chamber and a carbon hydrator tower will produce phosphoric acid from elemental phosphorus for The American Agricultural Chemical Company at their Carteret, New Jersey plant.

The graphite combustion chamber shown above – the largest in diameter ever installed–is being built with precisely machined graphite parts from National Carbon Company. It is 37'-3" high with an inside diameter of 20'-4". Phosphorus burned with air within the chamber is subsequently hydrated in the carbon tower shown at the left to produce phosphoric acid. This carbon hydrator is also the largest NATIONAL CARBON has ever built.

NATIONAL CARBON's graphite and carbon materials are well suited to this application because they provide corrosion-resistance and structural stability at elevated temperatures combined with ready machineability and moderate costs.

NATIONAL CARBON Has Facilities for Precise Machining of Large Structures

Photos show close tolerance machining of a wall block and factory preassembly of a block type graphite vessel for high temperature chlorination. Machining was done on new moving-bed horizontal milling equipment to tolerances of ± .010". The entire unit was pre-assembled in the plant with .010" thick shims to simulate cement joints to be made in the final installation. Men with years of experience in machining carbon and graphite working with modern equipment make this close tolerance work possible.

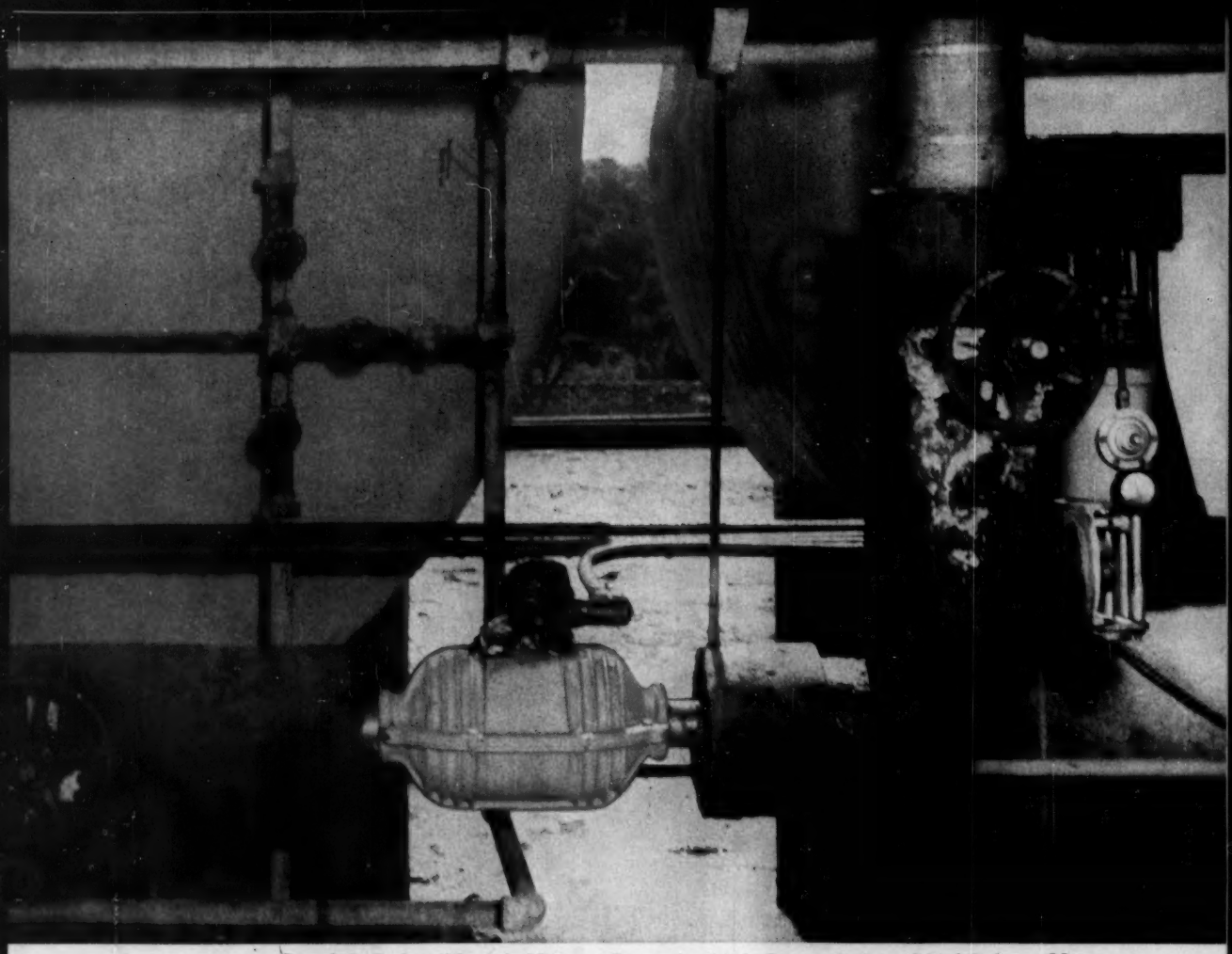


Working closely with NATIONAL CARBON's production staff are sales and technical service engineers with the industry's most extensive know-how in the design of carbon and graphite equipment for high temperature service. This combination of process knowledge and production experience makes National Carbon Company the leading supplier of graphite and carbon products used in the chemical process industries.

NATIONAL TRADE MARK

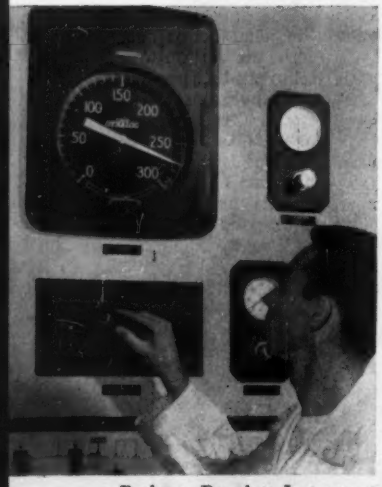
"National", "Karbate", "N" and Shield Device and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

UNION CARBIDE



One of six Foxboro Magnetic Meters at International Salt Company's Avery Island Refinery. Meters are measuring 220°F sodium chloride brine being discharged from filters on International's Recrystallizer Process.

Foxboro Magnetic Flow Meters handle 220°F salt brine just like water!



Foxboro Dynalog Instrument indicates flow rate through any one of the 6 Magnetic Meters — at the flip of a switch.

"trouble-free" – International Salt reports

220°F — that's the temperature of sodium chloride brine as it leaves filters at International Salt Company's Avery Island Refinery in Louisiana. And their 6 Foxboro Magnetic Meters have been providing continuous, trouble-free flow measurement of this highly corrosive liquid for over a year.

These meters easily handle this punishing chemical. They're lined with corrosion-proof Kel-F — have no flow restrictions of any type. Linear measurement — accurate to ±1% across the entire scale — is indicated on remote Foxboro Dynalog* instruments.

Since its introduction 5 years ago, the Foxboro Magnetic Meter has simplified the measurement of difficult liquids in hundreds of industrial processes. Ask your nearby Foxboro Field Engineer how it can help your process. Or write for Bulletin 20-14. The Foxboro Company, 364 Neponset Avenue, Foxboro, Massachusetts.

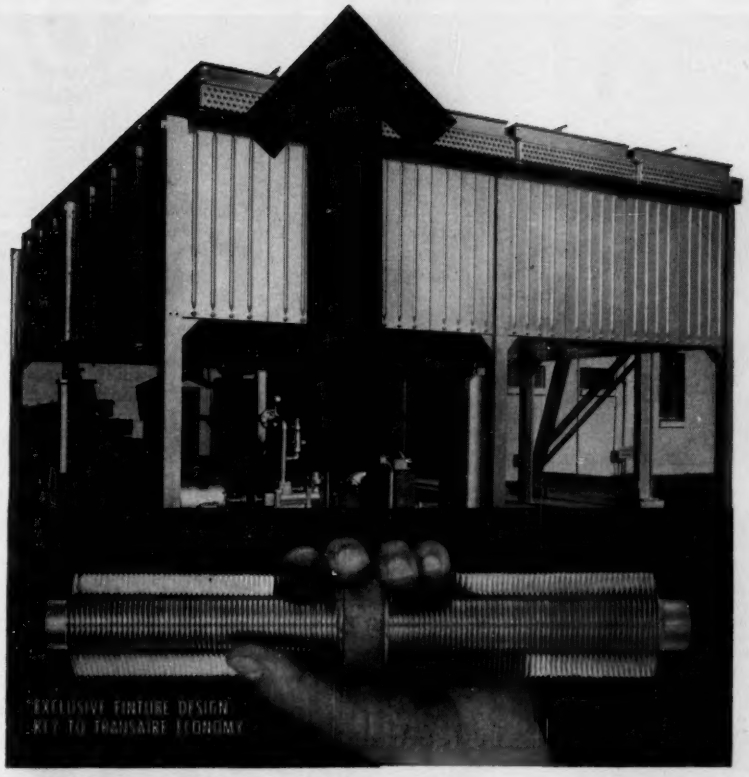
Reg. U. S. Pat. Off.

FOXBORO

REG. U.S. PAT. OFF.

WASTE HEAT LEAVES

...AT LOW OPERATING COST



Transaire Air-Cooled Heat Exchangers use free air for most economical heat dissipation

When waste heat is to be dissipated, Transaire Air-Cooled Heat Exchangers do the job efficiently and economically. Simple in design, Transaire units are now being used in many varied processing operations. Even in areas where water is unlimited, the cost of providing cooling towers, pumps, water treating, etc., makes the use of Transaire exchangers attractive.

Transaire exchangers are mechanically and structurally designed to give low maintenance and operating cost for extended periods of operation. High heat transfer efficiency is obtained by use of the Aimco fintube, an exclusive Yuba design with tapered spiral fins mechanically bonded so that the entire base tube is covered and protected against galvanic action. Fins are usually aluminum, although other materials are available for special requirements. Base tubing can be provided in practically any material, size or gauge desired. Fin spacing and height can be varied.

Next time specify economical Transaire, or if your present units are structurally sound, investigate modernizing through replacement with the new high efficiency Aimco fintubing.

Yuba also manufactures a complete line of shell and tube heat exchangers, and will recommend either type, whichever is required or best suited for the job.

YUBA

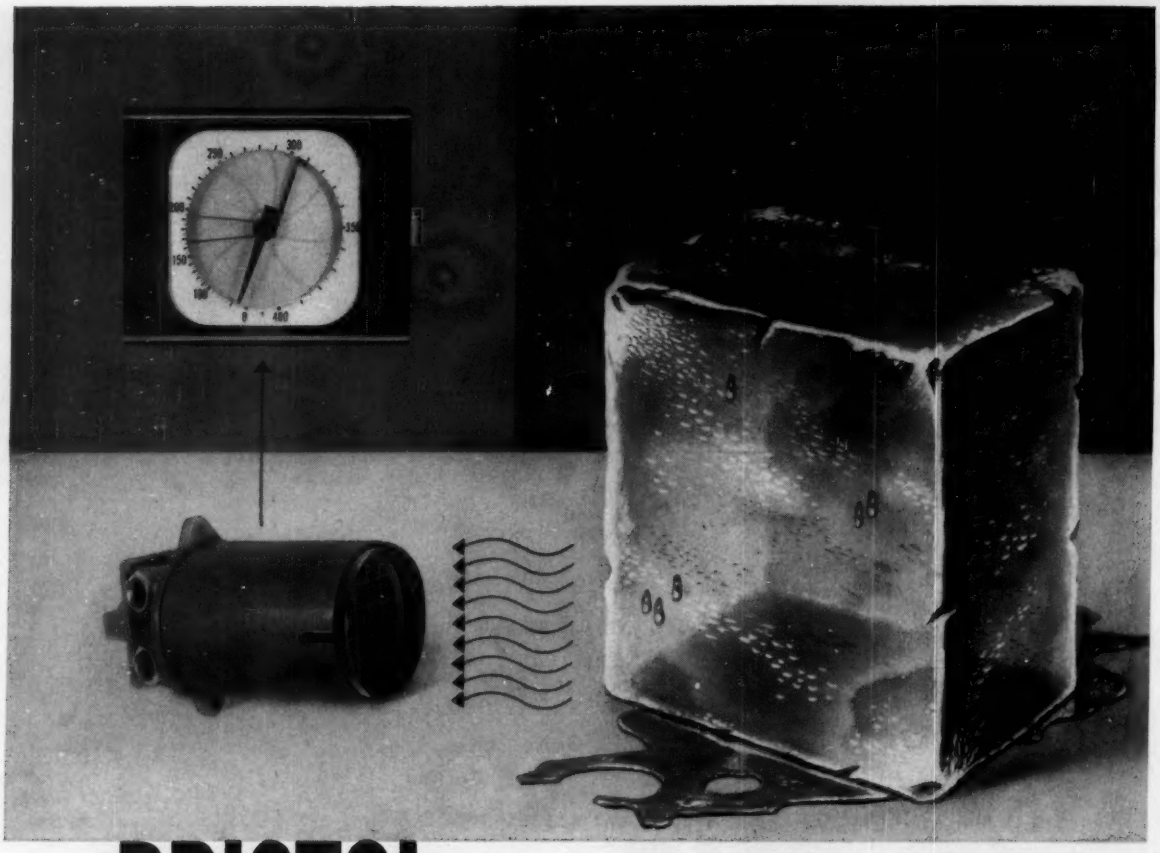
specialists in heat transfer equipment

YUBA-AIMCO DIVISION

801 West 21st Street, Tulsa, Oklahoma

YUBA CONSOLIDATED INDUSTRIES, INC.

Sales Offices in Atlanta • Buffalo • Chicago • Cleveland • Houston • Los Angeles • New York • Philadelphia • Pittsburgh • San Francisco • Seattle



new BRISTOL low-range radiation pyrometer

IDEAL FOR NO-CONTACT, CONTINUOUS TEMPERATURE MEASUREMENTS ON

Rubber	Plastics
Synthetic rubber	Carpeting
Tile	Mineral aggregates
Roofing shingles	Chemical flows
Adhesives	Petroleum flows
Blackened or unpolished aluminum	Beverage flows
	Reactor kettles
	Mill rolls
Textiles, synthetic and natural fibres	Furnace or oven charges or exteriors
Paper	Foundry molds

...and many other substances; web processes or products; conveyed, rolled or extruded products; and stationary objects.

0-200° F and other ranges to 1100° F • Direct reading charts, scales in F or C • Calibrated interchangeable head units • Automatic built-in ambient compensation • Easy emissivity compensation

Here's the first radiation pyrometer that really gets down to 0° F.

It's the Bristol Velotron Pyrometer System—so sensitive you can sight the radiation unit (at lower left above) on your hand and get an accurate temperature indication.

And on the high end, spans and ranges are available up to 1100° F or corresponding ranges in degrees Centigrade.

Charts and scales are direct reading, in degrees F or C, even on the lowest ranges. No laborious calibration runs, calculations; no curve consulting needed! And you get famous Bristol Dynamaster* Recorder accuracy —proven in thousands of installations.

Ambient temperature compensation is automatic, completely contained in recorder unit (no third unit needed), and allows use in ambients up to 135° F.

A simple knob adjustment allows compensation for emissivity characteristics of target material from black body on down.

Interconnection cables are standard copper wire; no special, preselected lengths required.

Write for complete technical data on this outstanding new Bristol contribution to industrial pyrometry. The Bristol Company, 109 Bristol Road, Waterbury, Conn. D 31

*T. M. Reg. U. S. Pat. Off.

BRISTOL...for improved production through measurement and control

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

Here's your complete guide to steam heating coils in fan systems

HB Blast Heating Coils for most general purpose heating, ventilating and air conditioning. Copper tube and aluminum or copper fin construction for steam pressures up to 200 psi. Available in face areas from 1.88 to 29.17 sq. ft., standard, medium and low temperature rises.

HD Steam Distributing Tube Coils also used in heating, ventilating and air conditioning systems. Each tube is fed from an inner perforated supply tube providing uniform steam distribution when throttling. Ideal where input air is at freezing temperature. Sizes and performances identical with Blast Heating Coils.

Heavy Duty Coils built with finned tough wrought iron pipe to resist internal and external corrosion in continuous duty high pressure systems and industrial processes—*exclusive with Westinghouse*—face areas range from 3.33 to 29.10 sq. ft., steam pressures up to 200 psi.

Sturtevant Division fan system components include Air Handling, Air Cleaning and Heating & Cooling Products—all from a single source with a single warranty—*best* for service and satisfaction.

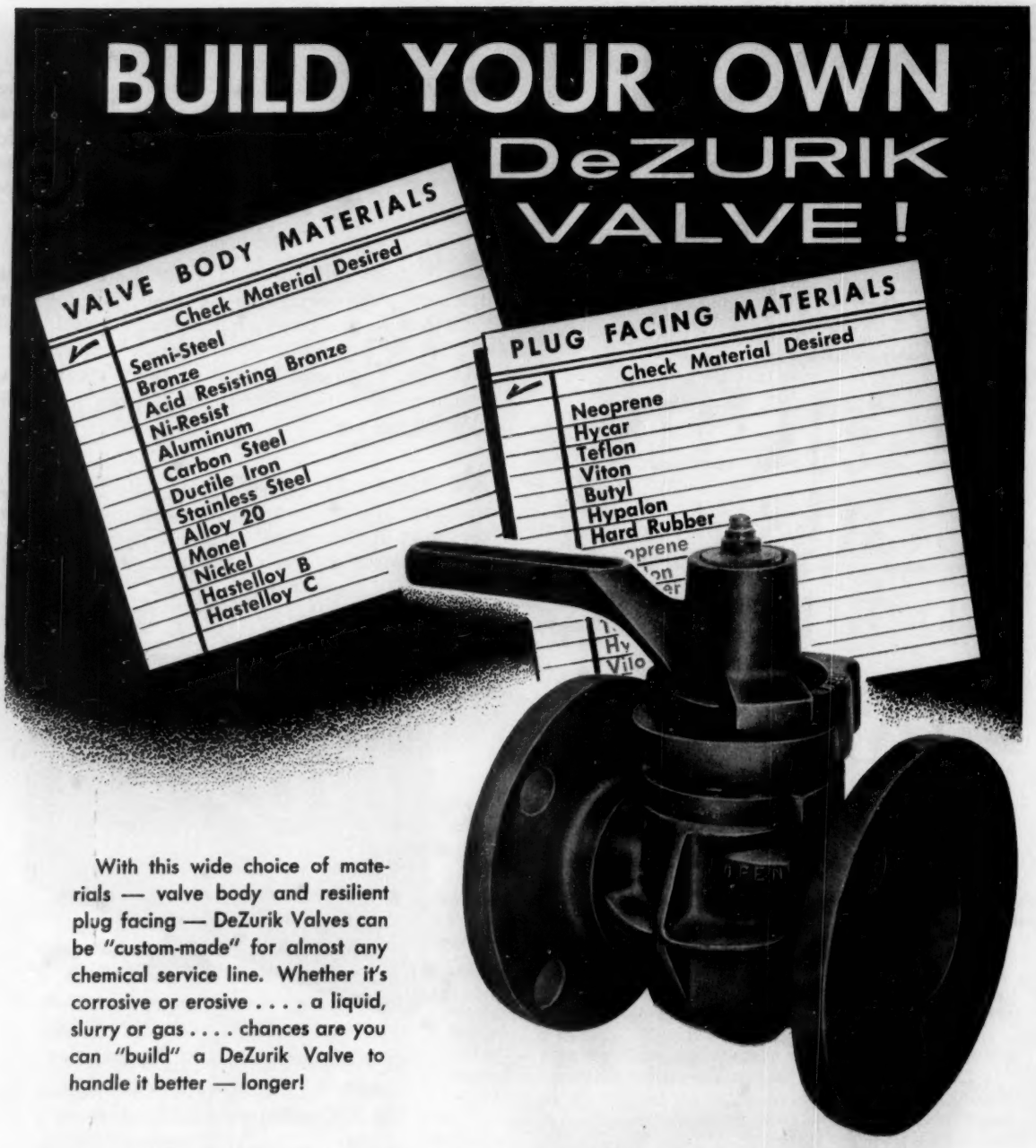
Call your Sturtevant Division Sales Engineer or write Westinghouse Electric Corporation, Dept. DD00, Hyde Park, Boston 36, Mass. *. . . Pioneers and pacesetters in air treatment for 100 years.*

YOU CAN BE SURE... IF IT'S Westinghouse

J-80700

Watch Westinghouse Desilu Playhouse on CBS Alternate Fridays.

BUILD YOUR OWN DeZURIK VALVE!



With this wide choice of materials — valve body and resilient plug facing — DeZurik Valves can be "custom-made" for almost any chemical service line. Whether it's corrosive or erosive . . . . a liquid, slurry or gas . . . . chances are you can "build" a DeZurik Valve to handle it better — longer!

In addition to the materials listed above, DeZurik Valves are also available with *Hard Rubber Lining* or *Soft Rubber Lining* for extra resistance to abrasive or corrosive services, or *Plastic Coated* for low-cost corrosion resistance.

DeZurik Valves are available in sizes ½" thru 24" and with a complete line of automatic actuators. For more details, see the DeZurik representative in your area, or write

DeZURIK CORPORATION
SARTELL, MINNESOTA

A New Era
in
Relay Life and Reliability

NEW
Bulletin 700, Type B-220A, AC Control Relay with 2 N.O. and 2 N.C. contacts.

NEW
Bulletin 700, Type BX-440A, AC Control Relay can be wired for normally open or normally closed contacts.

NEW ALLEN-BRADLEY BULLETIN 700 RELAYS

Improved features set new performance standards

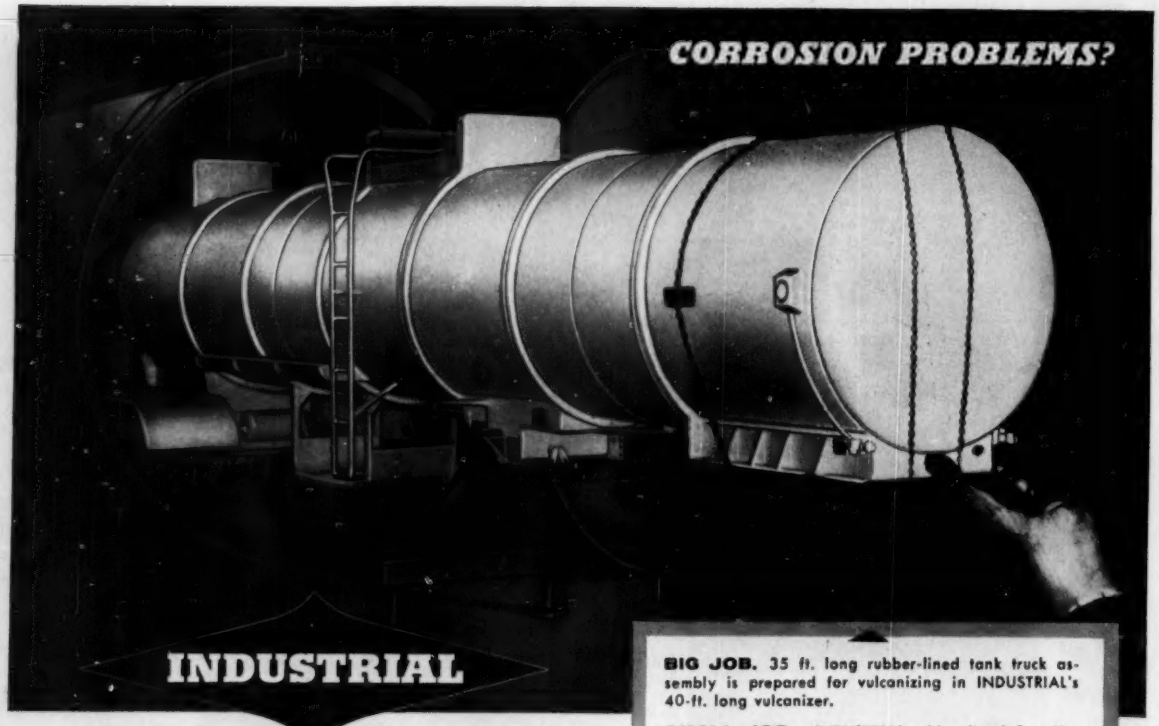
For years, Allen-Bradley Bulletin 700 Type B and Type BX relays have been preferred for their long life and trouble free operation. The improvements in the new Bulletin 700 Type B and Type BX relays will set new performance standards wherever they are used. Naturally they use the famous A-B double break, silver alloy contacts which always remain in perfect operating condition without cleaning or filing. The cast coil cannot be damaged by the severest atmospheric conditions.

These new Allen-Bradley Bulletin 700 Type B and Type BX relays offer even greater value and greater reliability than ever before—but the price has not been changed.

- **New mechanical design gives at least 5 times greater operating life.**
- **New contact motion provides 10 times greater electrical reliability.**
- **Complete interchangeability—mounting dimensions are unchanged.**
- **New hermetically sealed plastic coil fits Bulletin 700 relays presently in use.**
- **New, stronger, movable contact crossbar—also fits old relays.**
- **New reinforced stationary contact blocks—interchangeable with previous design.**

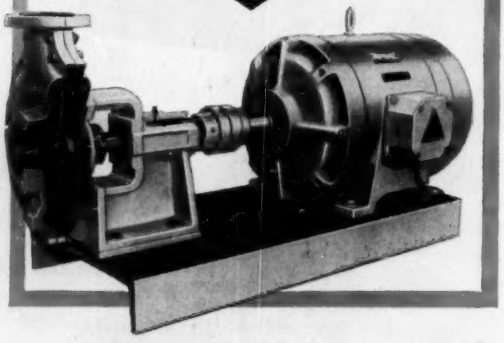
Allen-Bradley Co., 1337 S. First St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY Quality Motor Control



BIG JOB. 35 ft. long rubber-lined tank truck assembly is prepared for vulcanizing in INDUSTRIAL's 40-ft. long vulcanizer.

SMALL JOB. INDUSTRIAL rubber-lined Centrifugal Pumps give long life with minimum maintenance on the most severe corrosion service.



For Skilled Rubber Surfacing

. . . these complete facilities insure a *better* job at *lower* cost

INDUSTRIAL operates one of the largest rubber compounding and lining plants outside of the rubber industry. Here, tons of raw rubber are maintained in stock for formulating and compounding into compression molds and rubber linings to meet the *most specific* corrosion or abrasion-resistant services.

This extensive facility permits INDUSTRIAL to maintain the highest standards of quality control for rubber-lined processing equipment designed and built by INDUSTRIAL. In addition, it also provides a skilled, experienced and well-equipped source for *custom* sheet lining and compression molding to meet individual requirements.

All the benefits of INDUSTRIAL'S experience in designing, engineering and producing rubber components, and for applying it to the most intricate surfaces, is described in our RUBBER DIVISION bulletin. Write for your copy, today.

INDUSTRIAL Centrifugal Pumps are specifically designed for rubber lining. **As a result, they characteristically provide long, trouble-free life in corrosive or abrasive service . . . offering these design benefits:**

- **Mechanical Seal or stuffing box**
- **Easy access to pump seal**
- **Quick adjustment of impeller clearance**
- **Teflon seal cage (stuffing box only)**
- **Impeller insert welded to shaft**
- **One-piece, maintenance-free rotating element**

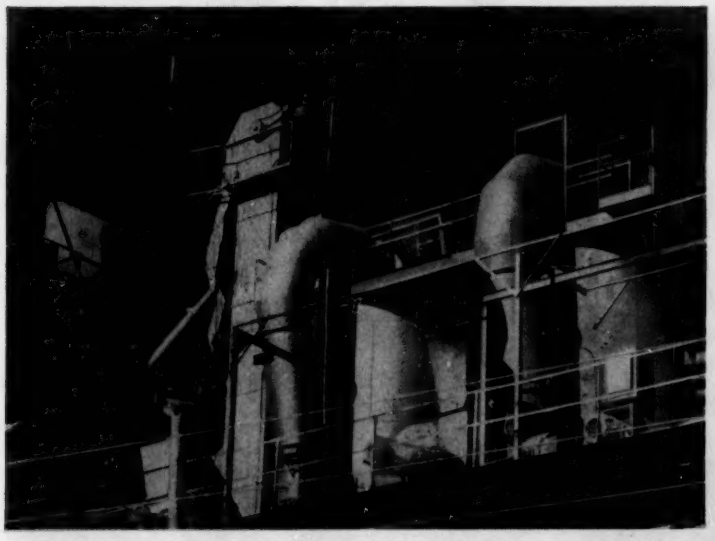
INDUSTRIAL

INDUSTRIAL FILTER & PUMP MFG. CO.
5918 Ogden Avenue,
Cicero 50, Illinois

C-159

SILICONE NEWS from Dow Corning

Found: A Paint that Lasts



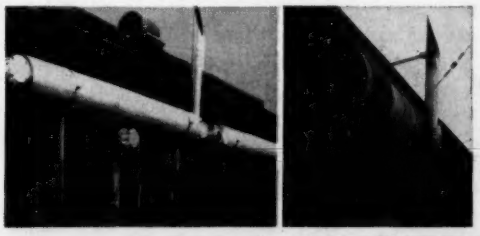
Cut Costs with New Long-Lived Silicone Finishes

You paint your plant to protect against rust and rot, but how can you protect the paint? Sun, rain, heat, sleet, smoke, and other elements of the industrial climate take a heavy toll. Shortly after the paint is completely dry, it starts to deteriorate. Soon, it must be re-applied. Thus, the cost of keeping away rust can run high: not due to the price of the coating material as much as to the repainting time involved.

Now, however, new paints based on silicone resins make it possible for you to make some really substantial cuts in paint maintenance costs. Proven to have superior durability, these silicone finishes last a good 25% to 100% longer. They keep their gloss and color and film integrity despite tough exposure to weather . . . despite high temperatures that burn or crack conventional finishes.

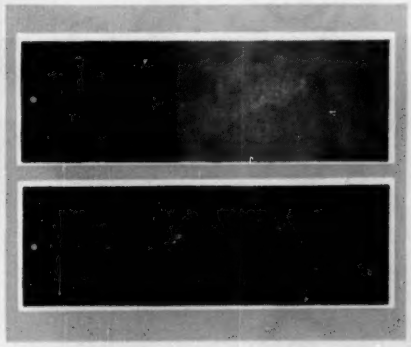
Naturally, this greater staying power means fewer repainting jobs. And that's especially important in hard-to-get-at areas of the plant, or on hot-running equipment that must be shut down for painting.

For instance, the Austin White Lime Company, of Austin, Texas, had difficulty keeping paint on the kilns and stacks shown above. Then they tried a paint based on Dow Corning Silicones, and report it ". . . by far the most satisfactory paint we have ever used." You can see the gleaming results.



Many other firms have come to the same conclusion. At left are two diesel mufflers at the Philadelphia Gas Works. Both were painted two years before these pictures were taken; one with an organic coating, the other with a silicone finish. The burned, cracked and discolored paint is the organic; the "like-new" coating is the silicone.

What if there's no heat problem, just weathering? New silicone-based coatings outlast conventional paints even where high temperatures are no problem. Look at the test panels in the photo. These panels have been exposed for one year in an industrial location where corrosive atmospheres frequently prevail. The conventional organic paint has faded, lost its gloss and chalked badly, while the silicone finish (bottom) is still in fine shape.



Colors Unlimited . . . Silicone finishes run the complete spectrum. If you want a hot-spot finish that will resist 1,000 F, certain pigments such as aluminum must be used.

But, when temperatures are not high enough to damage the pigment, you can get virtually any color you wish. This is important, for it means that, for the first time, you can carry color-coding systems over onto hot equipment without worrying about early paint failures.

Product finishes based on Dow Corning Silicones further prove the resistance to chalking, checking, fading and oxidation of these resins. For example: Sherer-Gillett, Marshall, Mich., a major producer of refrigerator display cases for supermarkets, has found a silicone-based enamel superior in durability . . . retaining high gloss after long wear . . . capable of absorbing more abuse.

Why not investigate silicone paints for your plant? Send today for the descriptive brochure, "Why Silicone-Based Paints Mean Less Maintenance." Write Dept. **2604.**

Your nearest Dow Corning office is your number one source for latest information and technical service on silicones.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

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DRY POWDERS

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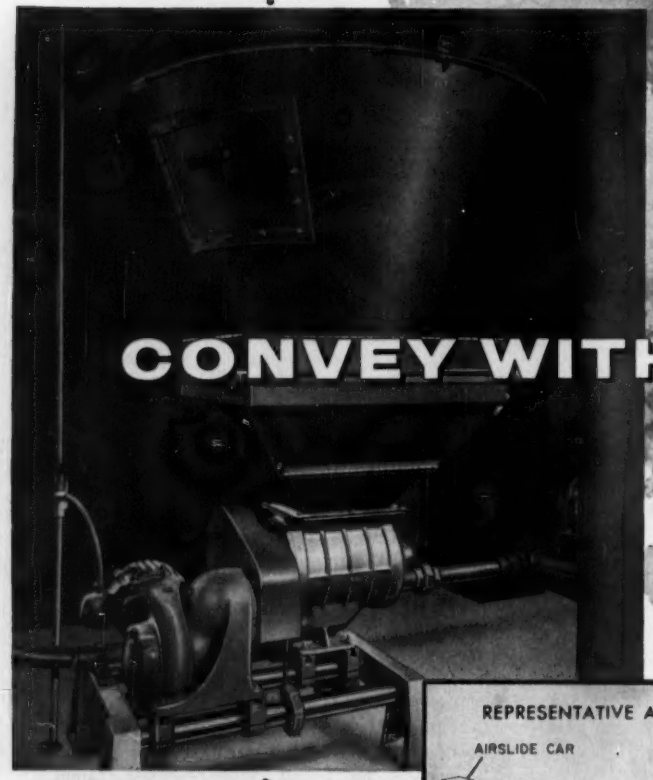
PHOSPHATE

POLYETHYLENE PELLETS

CHEMICALS

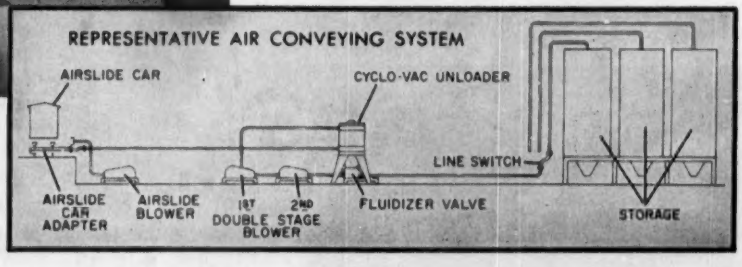
REDUCE COSTS



CONVEY WITH AIR

BENEFITS:

- Significantly lower handling costs for any powdered or granular material. Average savings: $3.60 to $6.10 per ton.
- Buy in bulk—eliminate cost of individual containers.
- Free valuable space and working capital
- Completely sanitary system



Most Advanced in Modern Air Handling

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THE FLUIDIZER COMPANY, A DIVISION OF SUPERIOR SEPARATOR CO.

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Houston—P. O. Box 654..... HO 5-5084

Los Angeles (Pasadena)—919 E. California Blvd.....MU 1-9766

Louisville (Jeffersonville)—204 Rosewood .....WH 4-0512

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Philadelphia (Bryn Mawr)—26 Summit Grove Ave..... LA 5-6261 LA 5-8699

Roanoke—P. O. Box 706..... DI 5-7442

St. Louis—5850 Delmar Blvd..... PA 6-1492

San Francisco (Daly City)—375 S. Mayfair Ave.....PL 5-8256

Seattle—1331 Third Ave..... MU 2-6195

Spokane—1324 N. Ash..... FA 7-6624

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Montreal—P. O. Box 1043, Station "O" .....RI 4-4967

ACID ATTACK?

You're safe with Lapp Chemical Porcelain Valves!

Now you can valve acids as easily as water! The solid porcelain of these Lapp valves is chemically inert, immune to corrosion from all acids (except hydrofluoric), and absolutely impervious. There's *extra* protection, too, in the TUFCLAD® armor that cushions the porcelain body against impact and insulates it against thermal shock.

Best of all . . . Lapp Chemical Porcelain Valves cost you far less than corrosion-resistant alloys and lined equipment. And they practically never need maintenance or replacement.

There's a full line to fit your process . . . Y-Valves and Angle Valves, in ½" to 6" sizes. Also safety valves, check valves, plug cocks, pipe, fittings (to 8" diameter), and special shapes.

WRITE *for Catalog 567.*
Lapp Insulator Co., Inc.,
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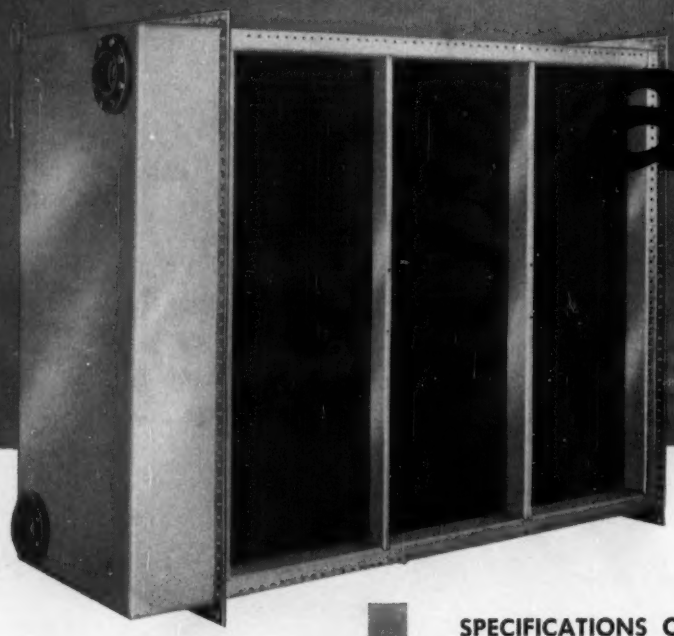
Lapp
CHEMICAL PORCELAIN

Marlo Liquid/Gas Heat Exchangers



any APPLICATION, ALLOY, OR SIZE

Write or Phone for Additional Information for Your Application.

SPECIFICATIONS ON THIS UNIT:

MATERIAL: 316 ELC Stainless Steel
Face Dimensions: 60″ x 72″
Overall Dimensions: 98″ x 68″ x 30″

TUBES: 0.035″ wall, ⅝″ O.D.
Spacing: 1½″ center to center, staggered

FINS: 0.010″ plate type with die-formed ferrules
Spacing: 8 per inch

SURFACE: Total: 10,650 sq. ft.
Primary: 558 sq. ft.

CASING: Air tight at 60 inches W. G.

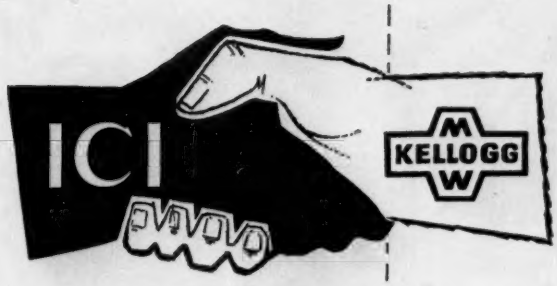
OPERATING PRESSURE: 1500 p.s.i.

WEIGHT: 5100 lb. dry

Marlo coil co.

SAINT LOUIS 11, MISSOURI

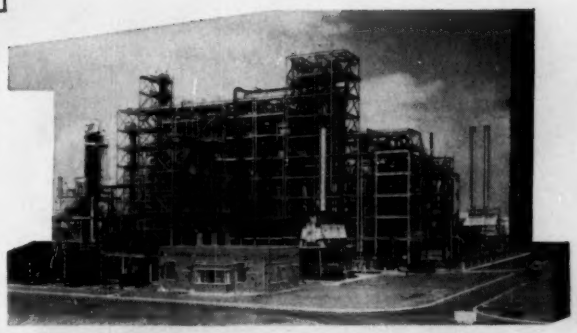
Quality Air Conditioning and Heat Transfer Equipment Since 1925



KELLOGG BUILDS FOR I.C.I. EXPANSION

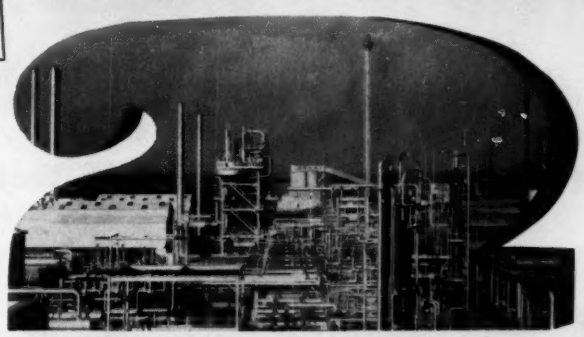
1951

Recent completion of Imperial Chemical Industries' third olefin plant at Wilton, England, has made these Works the largest petrochemical venture outside the United States. With a current output of 110,000 tons per year of high-purity ethylene, and a potential output of 140,000 tons, I.C.I. Wilton is an outstanding example of engineering cooperation.



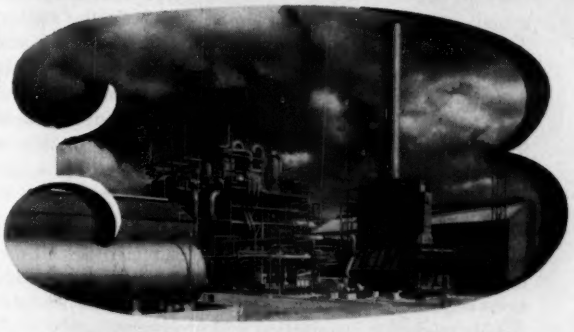
1956

The first plant was commissioned in 1951, and was the first full-scale adoption of the then novel process of oil pyrolysis developed in the Kellogg Laboratories. Its success led to the addition of No. 2 plant in 1956, and then to this latest extension, representing a 60% increase in olefin capacity, in 1959.



1959

Cooperation between client and contractor is the keynote of Kellogg's contribution to chemical engineering. The Wilton Olefin Plant is the largest in the world based on liquid feedstock. Kellogg is proud to have been associated with its development.



To learn more about Kellogg's background in engineering and building olefin plants, at home and overseas, write for current Kelloggram

THE M. W. KELLOGG COMPANY

711 Third Avenue, New York 17, N. Y. *A Subsidiary of Pullman Incorporated*

Offices of Kellogg subsidiary companies are in Toronto, London, Paris, Buenos Aires, Rio de Janeiro and Caracas

BUILDING-BLOCK FLEXIBILITY. 6" x 6" transistor control panels permit adding and removing of circuits in your plant by your own electrician.
FINGERTIP OPERATOR CONTROL. Small potentiometers greatly reduce size of operator's control panels and are dust tight for maximum protection.
RUGGED FLEXITORQ MOTORS. Very high commutating ability, 400% short time and 150% continuous overload capacities, fast acceleration and deceleration.
DEPENDABLE TRANSISTORS. Rated 35 volts, but stressed to only half their normal rating. Unusually high gain with twice the speed of response and only half the drift in gain of tubes. Transistors never fade—normally provide 15 or more years of service.

The New LOUIS ALLIS Select-A-Spede® Drive —First with field-proved All-Transistor Control

a high-gain, high performance d-c drive with unmatched flexibility and low upkeep

Here's a superior adjustable speed drive with simplified transistor-magnetic amplifier control. It's the easiest drive to set up and operate. A twist of the dial gives you stepless speed adjustment from zero to full speed in either direction. Each adjustment is independent, thus sparing you the need for compensating adjustments of inter-related settings. You get more consistent day to day operation because transistors — *unlike tubes* — are highly dependable.

The new Select-A-Spede defies obsolescence. To add functions you simply have your electrician install any of 13 "building-block" control circuits as your conditions require. These circuits come on inexpensive 6" x 6" panels ready for installation and are immediately available from Louis Allis stock. Thus a rebuilding or adaptation job that, on former equipment, cost thousands of dollars — excluding downtime — can now be done at a fraction of the cost and time *right in your own plant!* High quality transistors, field proven in missiles and other advanced electronic equipment, assure you of a high degree of dependability with a life expectancy of 15 or more years. Printed low-voltage transistor circuits are virtually trouble-free and can be quickly and easily replaced from low-cost stock.

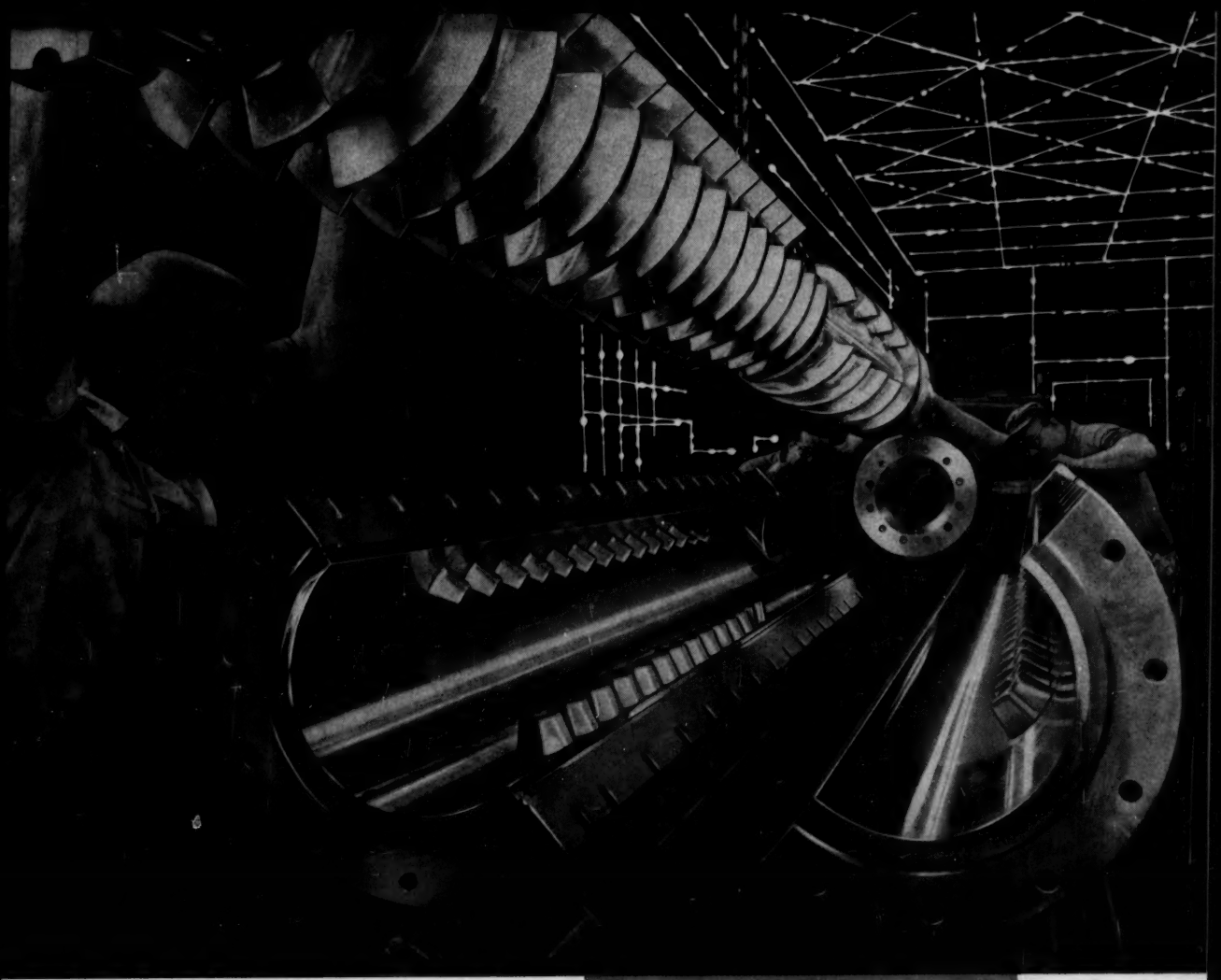
Further savings are provided by the new Louis Allis Flexitorq® drive motors through vastly improved commutation, low brush wear, and their ability to safely withstand momentary overloads of 400% of normal horsepower rating.

Select-A-Spede sizes from 5 to 400 hp, speed ranges up to 20:1. Contact any one of the 60 Louis Allis District Offices for information and application assistance. Or write for bulletin 2001 to The Louis Allis Co., 447 E. Stewart Street, Milwaukee 1, Wisconsin.

LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

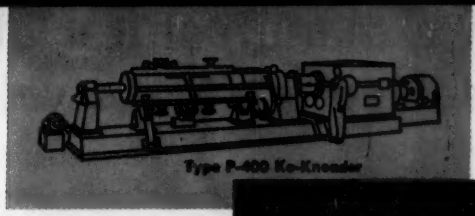
SA-202

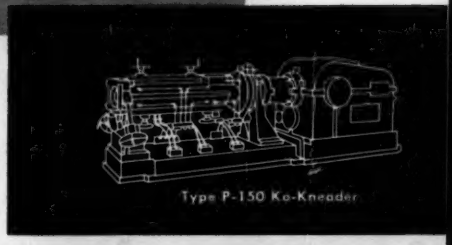


B·P

KO·KNEADERS (LIST SYSTEM)

precision built for efficient continuous mixing



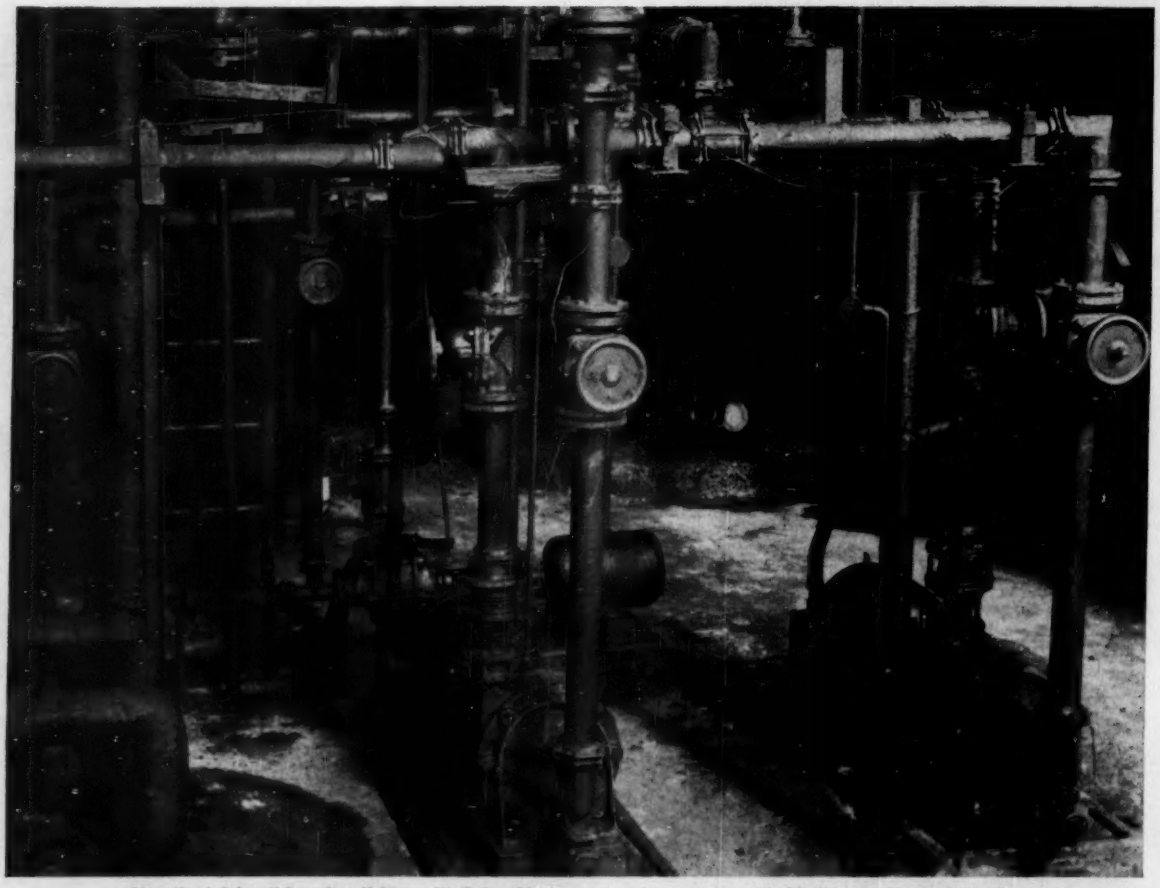


Precision built and skillfully engineered Baker Perkins Ko-Kneaders will convert your inefficient batch process to faster, more continuous operations. Less floor space is required and maintenance costs are materially reduced. With a Ko-Kneader, you not only get more production at less cost, but you give your customer a superior product, too.

B-P Ko-Kneaders are now mixing a wide variety of products such as plastics, carbon electrodes, food specialties, floor tile, solid rocket propellant fuels and many others. From this experience, proper recommendations can be made for your operation. However, if a new mixing problem is involved, test demonstrations can be arranged in the Baker Perkins Laboratory. Write today for engineering manual K-57 or contact your nearest Baker Perkins sales engineer.

BAKER PERKINS INC. CHEMICAL MACHINERY DIVISION
SAGINAW, MICHIGAN

393



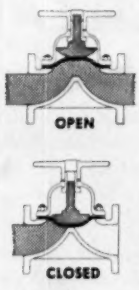
Glass-lined Grinnell-Saunders Valves, with Teflon Diaphragms, on benzene hexachloride lines at Diamond Alkali's Greens Bayou, Texas, plant. Hundreds of other Grinnell Diaphragm Valves are used in other areas of the plant.

How a manufacturer of benzene hexachloride solved a serious valve leakage problem

Valving at Diamond Alkali's Greens Bayou, Texas, plant had become expensive. Leakage of a product containing 30% to 40% benzene and free chlorine released fumes and caused rapid corrosion of the metal parts of the valves used previously, as well as of adjacent equipment.

This problem was corrected when Grinnell-Saunders Diaphragm Valves were used. The first replacement of any part of the Grinnell Valves did not occur for two years, and this was the diaphragm *only*. The former valves had to be *completely* replaced every one to two months! Bodies of the Grinnell valves lasted four years. In short, when Grinnell-Saunders Diaphragm Valves were installed, stem leaks ceased; corrosion was eliminated; and downtime to install new valves was practically ended.

For further facts about Grinnell-Saunders Valves, see Grinnell's insert in Chemical Engineering Catalog, or Sweet's Plant Engineering File — or write directly to Grinnell Company, Providence 1, Rhode Island.



- Diaphragm lifts high for streamline flow in either direction
- Diaphragm presses tightly to effect positive closure
- No packing glands to need attention
- Diaphragm easily replaced without removing valve body from the line
- Wide choice of body, lining and diaphragm materials

GRINNELL-SAUNDERS DIAPHRAGM VALVES

GRINNELL COMPANY, PROVIDENCE 1, R. I. • BRANCH WAREHOUSES AND DISTRIBUTORS FROM COAST TO COAST
PIPE FITTINGS • VALVES • PIPE HANGERS • PREFABRICATED PIPING • UNIT HEATERS • PIPING SPECIALTIES

From the wellhead through the refinery gate BRIDGEPORT TUBES HELP CARRY THE LOAD

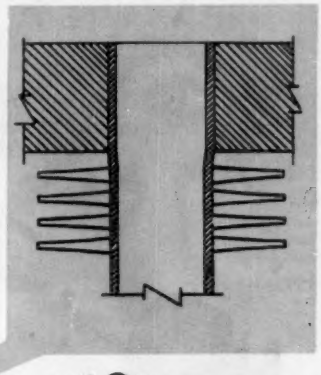
Right from the wellhead—Bridgeport is in the oil and gas production picture with aluminum, brass and copper base alloys in corrosion-resistant, single-wall and duplex tubes.

In natural gas production, for example, air-cooled heat exchangers at the wellhead do an around-the-clock job in both radiating the heat from the compressor engine and cooling the compressed gas before it is sent on its way to the gathering stations.

The air cooler illustrated here is manufactured by Air-X-Changers, Inc., Tulsa, Oklahoma. This model uses aluminum fins on Bridgeport Arsenical Admiralty condenser tubes. The tube bundles are mounted in a chamber, and fan-blown air across the finned surface cools either the compressor engine jacket water or the interstage and after-stage compressed gas. Bridgeport Inhibited Admiralty tubes are generally preferred for this type of service because of their corrosion resistance to both water and gas. And Bridgeport Aluminum Fin Stock is specially engineered for applications like this.

The range of Bridgeport condenser tube alloys—both single wall and duplex—is equaled by our vast experience in dealing with the special corrosive media encountered in the oil industry. This combination of quality products and technical engineering service pays you *all along the line.* Learn more about the benefits of Bridgeport Tubes and Technical Service for your applications. Write Dept. 5004.

Cross section of Air-X-Changer tube shows it expanded into tube sheet and individual aluminum fins positioned.



OIL'S FIRST CENTURY
-BORN IN FREEDOM
WORKING FOR PROGRESS

Bridgeport

BRIDGEPORT BRASS COMPANY

Bridgeport 2, Conn. • Sales Offices in Principal Cities

Specialists in Metals from Aluminum to Zirconium

Cost-cutting step taken 26 years ago still paying off at Hamm Brewery –they chose NONPAREIL Turbine Oil

Situation: In 1934 the Theo. Hamm Brewing Company installed two 1,000 kw. turbines. The brewing firm wanted to be sure there would be no downtime due to failure of the lubricant. Neither did the company want to spend time checking the oil's performance or adding new oil to sweeten the old.

What was done: Brewery management followed the advice of the Standard Oil lubrication specialist. They installed NONPAREIL Turbine Oil, the only oil, then as now, that carries with each fill a life-of-turbine guarantee.

What has happened: In 26 years since the turbines were put in service there has never been any downtime due to lubrication problems. In 1947 a 2500 kw. turbine was added to the system and another 3000 kw. unit was put in service in 1953. These, too, have used NONPAREIL Turbine Oil with the same results.

What you can do: Get the full story on NONPAREIL Turbine Oil from the Standard Oil office near you in any of the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

Quick facts about **NONPAREIL Turbine Oil**

- Will not permit formation of harmful acids
- Will not permit formation of sludge or oil varnish
- Will maintain good demulsibility or water separating characteristics
- Has high resistance to foaming
- Contains adequate rust inhibitor

You expect more from **STANDARD** *and you get it!*

Hamm Brewing Co. assistant chief engineer Steve Wappel and Standard's Dick Anderson discuss recent oil analysis. Dick Anderson knows his way about an industrial power plant. He's been providing customers with technical service on lubrication for five years. Dick has an engineering degree from the University of Minnesota and has completed the Standard Oil Sales Engineering School.

In a variety of applications Roots Vacuum Pumps deliver

A *RCV 10x20 unit providing vacuum for ore purification.*
B *RCV 8x16 units in a carburetor testing operation.*
C *RCV 12x18 units in Combustion Tests Section, U.S. Bureau of Standards.*
D *RCV-2 and RCV units supplying vacuum for newsprint making machine.*
E *RCV 10x18 and 10x15 units serving cigarette-making machines.*

MORE CFM PER DOLLAR

The high operating speeds of Roots-Connersville blowers for vacuum service result in lower horsepower requirements. Power savings of as much as 25% are possible. What is more, the simple, rugged rotary positive design of these vacuum pumps provides additional savings in initial cost, long-term investment, maintenance and floor space. These advantages are being demonstrated in a wide variety of mining, paper making, chemical processing, general manufacturing and testing operations.

Type RVS vacuum blowers are offered for efficient low volume service. Designed to handle capacities ranging from 30 cfm to 1,000 cfm, they can operate up to 20" Hg. vacuum in single stage construction.

Type RCV units are available for air and gas handling capacities from 500 to 13,000 cfm and are recommended for vacuums up to 17" Hg.

Type RCV-2 compound units consist of two RCV's on a single driving shaft and are recommended for highest efficiency from 18" to 27" Hg. vacuum when handling capacities from 1,500 to 15,000 cfm.

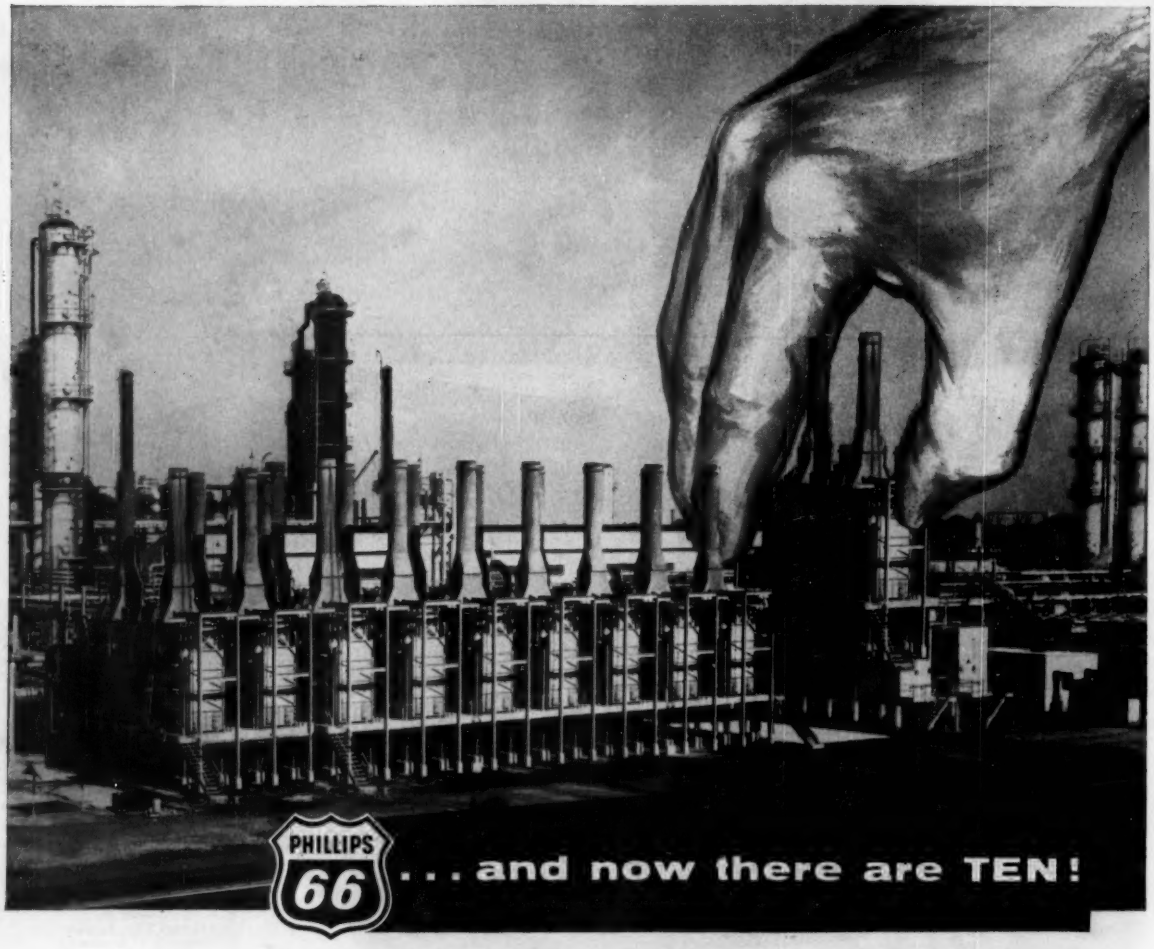
Your nearest Roots-Connersville sales engineer can give you full details. Or write for Bulletin VP-158 (RCV) and S-RVS-159 (RVS).

ROOTS
—first in air and gas handling equipment

ROOTS CONNERSVILLE
Rotary Positive Blowers & Meters • Gas Pumps • Vacuum Pumps • Spiramic® Compressors • Centrifugal Blowers

DRESSER INDUSTRIES INC.
OIL • GAS • CHEMICAL
ELECTRONIC • INDUSTRIAL

ROOTS-CONNERSVILLE BLOWER DIVISION • 460 ILLINOIS AVE., CONNERSVILLE, INDIANA
In Canada — Roots-Connersville Blower (Canada), Ltd. • 629 Adelaide Street, West, Toronto



Since 1957, when seven Selas Gradiation® heaters went on-stream, Phillips Chemical Company's, Sweeny, Texas, plant has had to increase production capacity *twice*, to meet the continuing booming demand for high-quality ethylene. On both occasions, this leading producer of petrochemicals has turned to Selas to help meet additional requirements.

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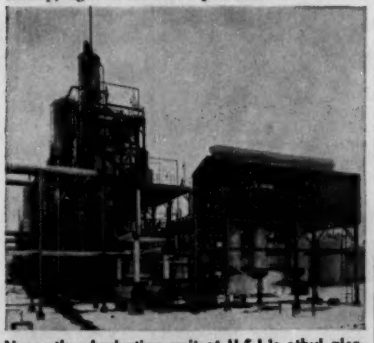
U.S.I. CHEMICAL NEWS

April ★ A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★ 1960

New Ether Hydration Unit Ups U.S.I.'s Potential Ethyl Alcohol Capacity

A new ether hydration unit has just been completed at U.S.I.'s ethyl alcohol plant, Tuscola, Ill. With the new unit it is now possible for the company to take part of its ethyl ether production, formed as a by-product of the ethyl alcohol production process, and convert it to ethyl alcohol. The new unit gives the company an additional potential capacity of up to 6,000,000 gallons of ethyl alcohol annually, figured on a 190 proof basis.



New ether hydration unit at U.S.I.'s ethyl alcohol plant, Tuscola, Illinois.

U.S.I. refines a portion of the by-product ether to U.S.P., A.C.S., Refined and Technical grades for industrial, institutional and laboratory use. Part of the remaining material can now be converted into a low-proof ethyl alcohol through a catalytic process developed by U.S.I. The low-proof alcohol is then introduced into the regular process stream at U.S.I.'s alcohol plant for conversion to 190 proof or anhydrous product.

The new ether hydration unit enables U.S.I. to have a flexible means of keeping alcohol and ether production in balance. The company can serve the needs of these markets without being restricted by facilities.

Sodium Treatment Found to Increase Carbon Activity

A recent study reveals that sodium treatment of activated carbon, which is known to increase the material's ability to adsorb inert gases, also improves its liquid adsorption characteristics.

For the binary mixture n-heptane with toluene for example, toluene adsorption is increased from 48% to 58%. For n-heptane with propyl sulfide, adsorption of the latter material climbs from 25% to 85%.

The activated carbon is treated by stirring it with molten sodium until a homogeneous mixture is formed. Selectivity of the carbon is not altered.

The research group believes that sodium treatment causes small gaps to form between the carbon sheets which are generally thought to make up the structure of activated carbon. These gaps, probably made by sodium atoms wedging between the carbon sheets, give the carbon structure a honeycomb appearance. A much larger surface is thereby produced for liquid or gas adsorption.

U.S.I. Pulp and Paper Lab Expands to Cover More Bleaching Problems

Technical Service Work Now Emphasizes Use of Chlorine and Caustic Soda in Multi-Stage Bleaching of Kraft. Studies on Sodium Peroxide Bleaching Continue.

U.S.I.'s pulp and paper laboratory at Ashtabula, Ohio, established over eight years ago to provide technical service assistance on pulp bleaching with U.S.I.'s sodium peroxide, has been expanded, with the staff now working on problems relating to the use of U.S.I. chlorine and caustic soda in the multi-stage bleaching of wood pulp.

These technical service facilities are typical of the best industry laboratories maintained by pulp and paper companies themselves. Therefore, U.S.I. is able and willing to handle requests for comprehensive evaluations and recommendations on bleaching systems, techniques and chemicals—usually aimed at achieving the brightest pulp with the minimum degradation in fiber strength.

How Pulp & Paper Lab Functions

In a typical call, W. F. Schroeder, who has a very extensive background and acquaintance with the paper trade, visits a mill, examines the bleaching operation and takes pulp samples back to the laboratory.

MORE

Polyurethane Foam Radome, First Ever Built, Now Under Test in Canada

In a program designed to provide ground shelters with greater dielectric "transparency" —to minimize energy loss and boresight error in radar tracking installations—the world's first polyurethane foam radome has been built and is under test by Canada's National Research Council.

The polyurethane dome is undergoing an extensive series of electronic tests using actual field radar equipment. From these electrical analyses, NRC expects to obtain data indicating the suitability of such foam for radar at the frequencies involved. Favorable results could lead to extensive use of such foam, particularly for missile tracking in anti-missile type radar systems.

Chlorination of kraft pulp on a laboratory scale in fume hood at U.S.I.'s pulp and paper lab, Ashtabula, Ohio. W. H. Schroeder has obtained a sample of filtrate for residual chlorine analysis. J. R. Leidich is checking weight of chlorine added to pulp.

April ★ **U.S.I. CHEMICAL NEWS** ★ 1960

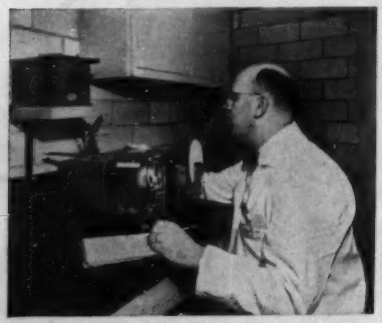
CONTINUED

Paper Laboratory

There the samples are bleached under a variety of conditions in a trial program based on knowledge of individual requirements and experience with many types of pulps. The bleached pulp samples are then made into hand sheets and tested for brightness and other necessary characteristics in a constant temperature, constant humidity testing room. Heat-aging studies can also be conducted. After all variables have been examined, a process is recommended for obtaining a bleached pulp that combines maximum brightness with maximum strength.

In the multi-stage bleaching of kraft—which usually involves treatment with chlorine, followed by caustic extraction and several whitening stages using bleaching agents such as hypochlorite, peroxide or chlorine dioxide—conditions of time, temperature, pH and pulp and chemical concentrations must be carefully worked out. U.S.I. technical service engineers are qualified to evaluate all the variables, including the type of equipment used.

U.S.I. interest in pulp bleaching arises from its sodium peroxide plant at Ashtabula, Ohio, and its two chlorine and caustic soda plants at Huntsville, Alabama. Further information on the pulp and paper technical service laboratory may be obtained by writing to U.S.I., 99 Park Avenue, New York 16, N. Y.



W. H. Schroeder determines brightness of a pulp handsheet on Hunter Multipurpose Reflectometer at U.S.I.'s pulp and paper laboratory.

Polyethylene Is Used For Radiation Shields

Polyethylene radiation shields, so thick they must be cut by specially designed saws, are being produced for use on atomic powered vessels. These polyethylene panels are intended to provide excellent protection from neutron bombardment and are lower in weight than conventional materials such as concrete and lead. The hydrogen nuclei in the polyethylene serve successfully to reduce the energy in the high energy neutrons created by atomic fission. A small quantity (1 or 2%) of boron, compounded with the polyethylene, absorbs the remaining low energy neutrons.

The polyethylene panels must meet rigid specifications and require critical quality control. They are made by a specially adapted extrusion technique which allows production of heavy gauge sheets. The shields can be made in standard widths over 36 inches and may be cut to any length according to specifications.

PETROTHENE® 100, a polyethylene resin supplied by U.S.I., is used to make the panels because of its ideal processing characteristics and because it passes all military specifications for radiation shielding.

Solox® Solvent Covered In New U.S.I. Data Sheet

Complete technical data on U.S.I.'s ethyl alcohol proprietary solvent SOLOX are given in a new, six-page data sheet. SOLOX frequently can be used in place of specially denatured alcohols because of its general utility and excellent solvent qualities. The permit and bond required for S. D. alcohols are not needed for SOLOX. It is noncorrosive, burns with a clean, colorless flame, leaves no residue and has a mild, nonresidual odor.

The new data sheet includes specifications, properties, compositions of the five SOLOX proprietory solvent formulations, and shipping information. Applications in lacquers, shellacs and varnishes, in the textile field, in chemical manufacturing, in cleaning compounds, as a fuel oil conditioner, in photography and as a fuel are described.

Government regulations pertaining to SOLOX complete the data sheet. Copies may be obtained from U.S.I. sales offices or from the New York office at 99 Park Avenue.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U.S.I.

Protective coating systems for concrete floors compared in new coating chart. Gives resistance of each system to chemicals, thermal shock, abrasion, temperature. Shows compressive strength, impact resistance, skid properties. **No. 1580**

Silicone products for antifoams, release agents, lubricants, cosmetics, polishes, water, repellents, paints, textile finishes and electrical insulation described in new bulletin. Silicone rubber compounds also covered. **No. 1581**

New hydrogen analyzer uses hot extraction principle to determine content of the gas in metals. Said to be compact, inexpensive, and to combine speed and accuracy with ease of operation. Used for checks, controls, studies. **No. 1582**

Blowing urethane foams with fluorinated hydrocarbons discussed in new brochure. Includes advantages of making foams this way; uses of urethane foams; physical properties of blowing agent, many foamed plastics, other insulation. **No. 1583**

Latest developments in cast polyethylene film described in new booklet which deals with film casting equipment such as chill rolls and dies, and gives a comparison of properties among cast, quenched and blown films. **No. 1584**

New miniaturized infrared gas analyzer is said to be smaller than portable TV set, to weigh only 30 pounds, to accurately measure and control furnace atmospheres, dew point, combustion, toxic and combustible gases, chemicals. **No 1585**

Two new thread sealants for storable rocket propellant systems are now available, one for nitrogen tetroxide (N_2O_4) and the other for unsymmetrical dimethyl hydrazine (UDMH). Neither is impact-sensitive in these propellants. **No. 1585**

Ozone chemistry and technology covered in collection of 60 papers presented at International Ozone Conference, now being sold. Ozone now tool for organic, analytical and photo chemists, meteorologists, plant physiologists. **No. 1587**

New gas chromotography analyzer, incorporating advanced developments such as Golay columns and ionization detectors, has been introduced. Detectors permit accurate measurement of sample components in the minute quantities resolved by the Golay column. **No. 1588**

Radioactive carbon-14 compound adenosine-3-C14 now available is a radioactive purine valuable in chemistry, biology, pharmacology. Useful in study of carbohydrate metabolism since it is a constituent of plant and animal nuclei. **No. 1589**

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Ammonium Nitrate, Nitric Acid, Nitrogen Fertilizer Solutions
Sulfuric Acid: all strengths, 60 Baume to 40% Oleum. Also Electrolytic grade to Federal specifications. Tank cars or tank wagons.
Sodium Peroxide

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Animal Feed Products: DL-Methionine, MOREA® Premix (to authorized mixer-distributors).

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Textile Technology in Chemical Engineering

The Final Test of a Filter Fabric

While appreciating the factors involved in the development of filter fabrics from fiber to finish, the practical processing engineer wants to get down to cases to see how filter fabrics perform under the acid tests of specific application.

A typical "acid test" may be found in the dyestuffs industry, where a dye intermediate is separated from a sulphuric and hydrochloric acid solution at 45 degrees C. This process, so corrosive that the filter press must be made of rubber-coated aluminum, successfully utilizes a spun dynel filter fabric designed for high chemical resistance, efficiency and durability.

Acids, of course, are not always the problem. A yeast manufacturer required a filter medium which would provide adequate flow while retaining very finely-divided yeast particles, would be smooth enough for easy cake discharge and sturdy enough to withstand filter press wear and frequent cleaning. A specially constructed cotton duck of close, firm texture proved the highly satisfactory and economical answer.

To get complete information about filter fabrics, make sure you consult a specialist. The specialists who distribute Wellington Sears filter fabrics are fully equipped to help you select the medium that best answers your problems. Behind them, they have our 114 years of experience in providing quality fabrics to industry. For distributors' names, and informative booklet, "Filter Fabric Facts," write Dept. **L-4.**

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Taking a New Look at Coal Chemicals

Despite cries of "It can't be done!" rising from many quarters, some chemical processors in this country are again talking about using coal as a raw material for "petrochemicals." Most ambitious of the proposed coal chemical complexes is that of Philadelphia & Reading Corp. which when completed would require a capital outlay of over $100 million (*Chem. Eng.*, Mar. 21, 1960, p. 75).

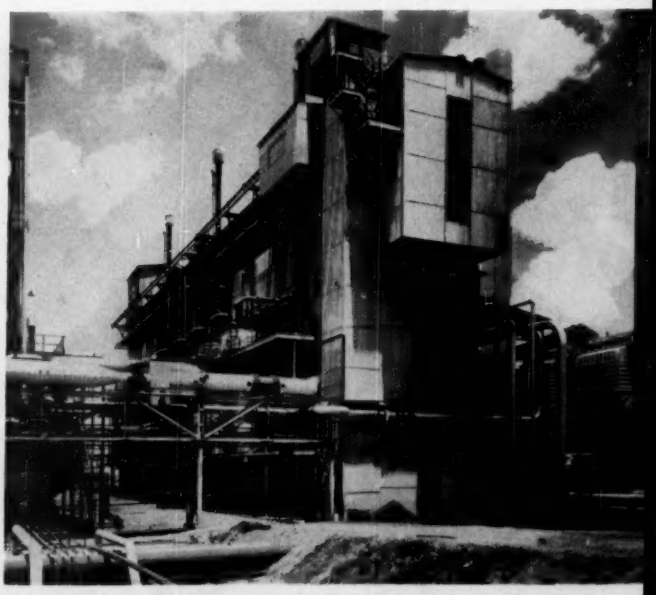
Now Glen Alden Coal Co., one of the nation's largest anthracite producers, says it has a "major chemical company" interested in erecting a $15-million chemical plant adjacent to Glen Alden's currently idle Loomis colliery near Wilkes-Barre, Pa. Plans for this project are still in the tentative stage and it is not known what chemicals are being considered. But Glen Alden Coal's president Harry Bradbury emphasizes his claim that freshly mined anthracite can be delivered to nearby chemical facilities at a cost competitive with any other carbon source.

▶ **Coal: Like the Phoenix?**—Manufacture of synthetic organics from coal has had a sad history in this country—although it is commercially successful in parts of the world where oil and natural gas are in short supply.

The unhappy experience of Du Pont's ammonia-from-coal plant at Belle, W. Va., Union Carbide's coal chemicals pilot plant at Institute, W. Va., and the ill-fated Carthage-Hydrocol plant at Brownsville, Tex., have soured many chemical engineers on the economics of coal chemistry. More recently, Consolidation Coal shelved indefinitely its plans for a fluid-bed low-temperature coal carbonization installation that would recover xylenes, coke and a carbon char for power generation. Reason for abandoning: Unattractive economics.

▶ **Straws in the Wind**—In spite of this undistinguished history, the long-term outlook for coal as a source of synthetic organics appears brighter than it has been for several years. Reason for this is the fact that oil and natural gas will experience significant price increases in the future because of rising exploration and production costs.

By contrast, price of coal will remain relatively stable—especially with the advent of at-the-mine processing and the solids pipeline.

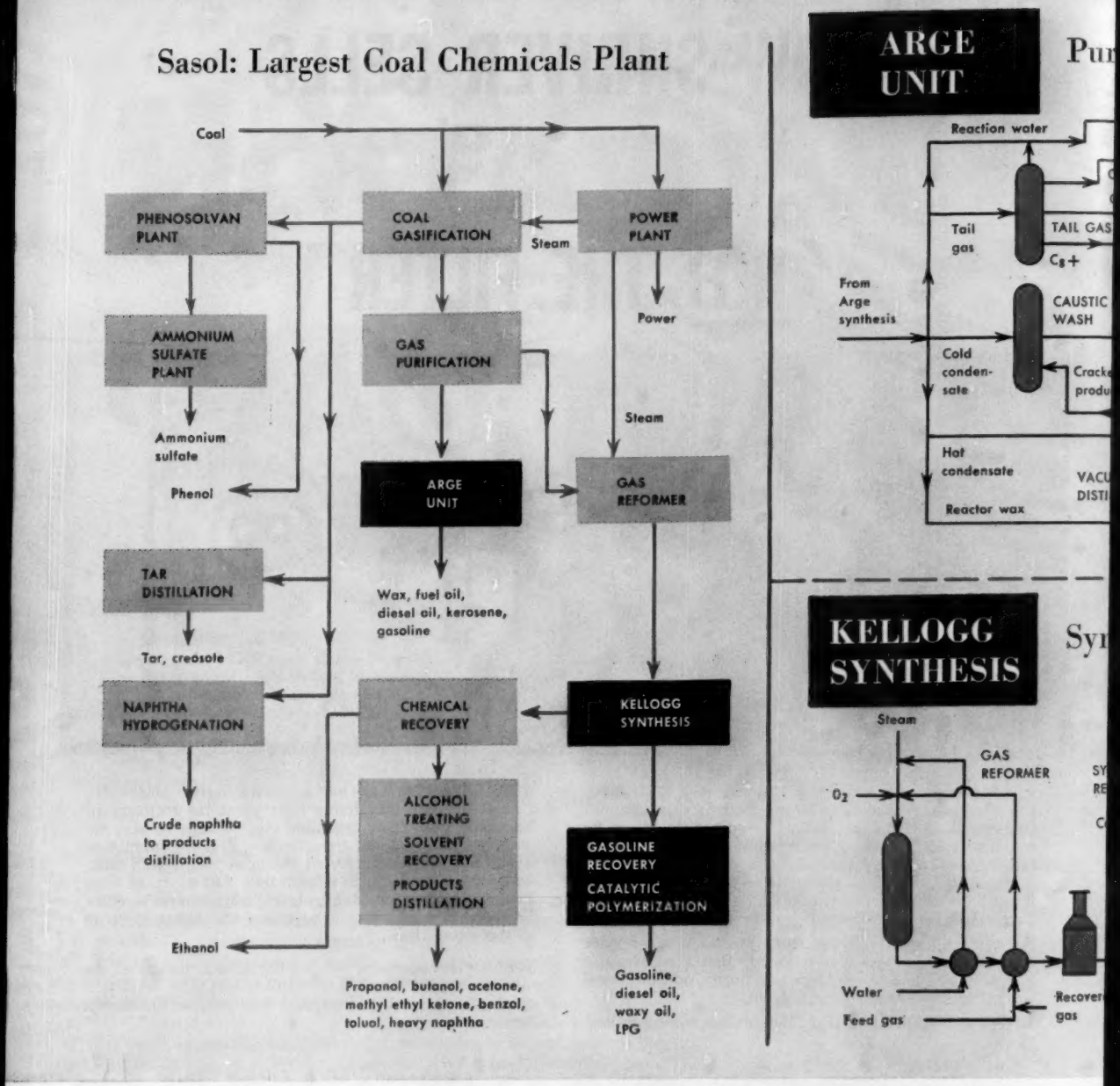


LURGI GASIFIERS, like the ones at the Sasol plant above, may soon be employed in a U.S. coal chemicals plant.

Recent estimates indicate that wellhead prices will jump almost 100% for natural gas and 20% for oil in the next decade. An official of one of the largest chemical companies (which now consumes large quantities of natural gas) believes an economic breakpoint will be reached before 1970 when coal will again become attractive for synthesis in certain parts of the country.

▶ **How It's Faring Abroad**—World's largest chemicals-from-coal plant is the huge South African Coal Oil & Gas Corp. (Sasol) plant near Johannesburg designed primarily to supply gasoline. This plant, which has been on stream for about four

Unfold Flowsheet



years, is possible because of South Africa's plentiful coal supplies coupled with a lack of crude oil.

And although the Sasol plant went through a prolonged shakedown period, especially in the Fischer-Tropsch synthesis section, the plant is now running smoothly. Sasol is now erecting a third Synthol reactor to boost gasoline capacity to 39 million gal./yr., a 35% jump.

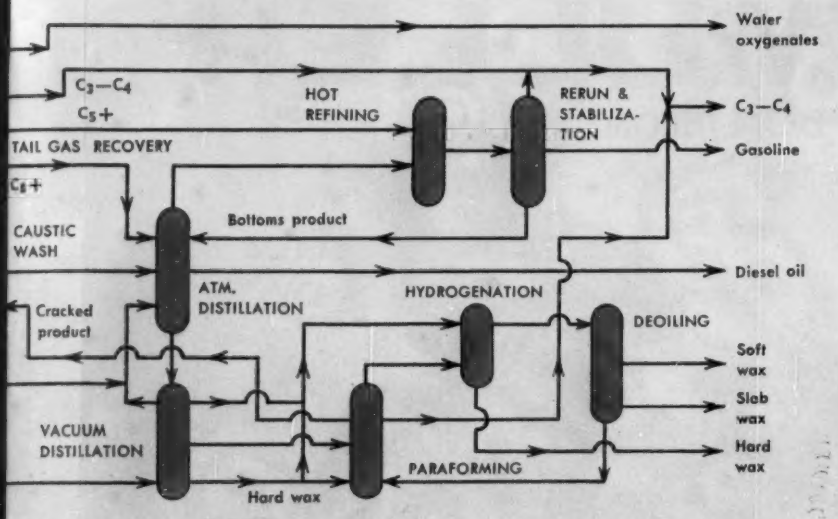
Additional gasoline capacity is part of an $11-million expansion program which may also lead to the production of polyethylene.

►**The Key First Step**—The most widely used method of converting coal into chemical building blocks (CO-H_2 synthesis gas) is the German-built Lurgi gasifier which treats coal with steam and oxygen under pressure.

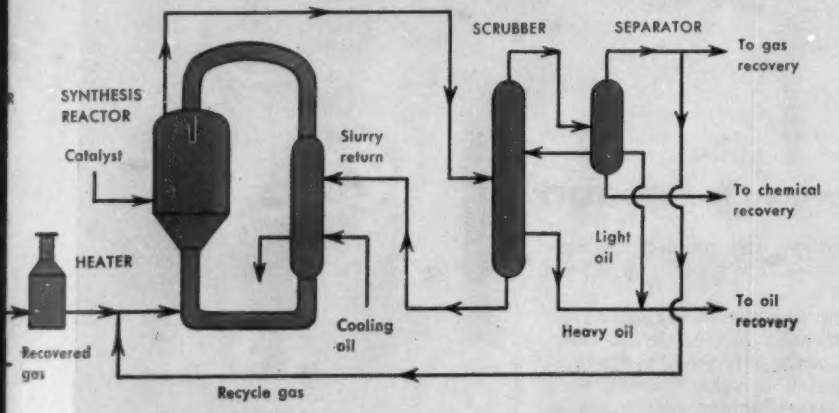
Lurgi gasifiers are the key to Philadelphia & Reading's chemical complex. It would probably require three or four units (at $1–1.5 million a piece) to provide the 50 million cu. ft./day of synthesis gas specified in P&R's plans. There are indications, too, that Lurgi-type units play a role in the plans of Glen Alden's mysterious chemical friend.

Nine Lurgi gasifiers, each 14 ft. dia. and 30 ft. high, are employed at the Sasol plant. Units each

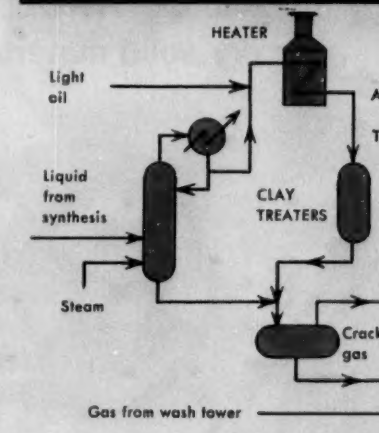
Purification Units Separate Arge Products

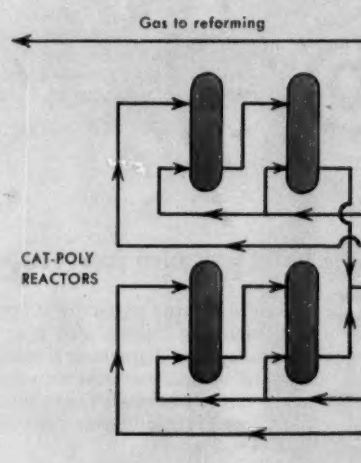


Synthesis Gas Converts to Liquid Chemicals



GASOLINE RECOVERY CATALYTIC POLYMERIZATI





produce 837,000 scfh. of synthesis gas with a typical analysis running 39.3% H_2, 31% CO_2, 18.7% CO, 10% CH_4, and 1% N_2.

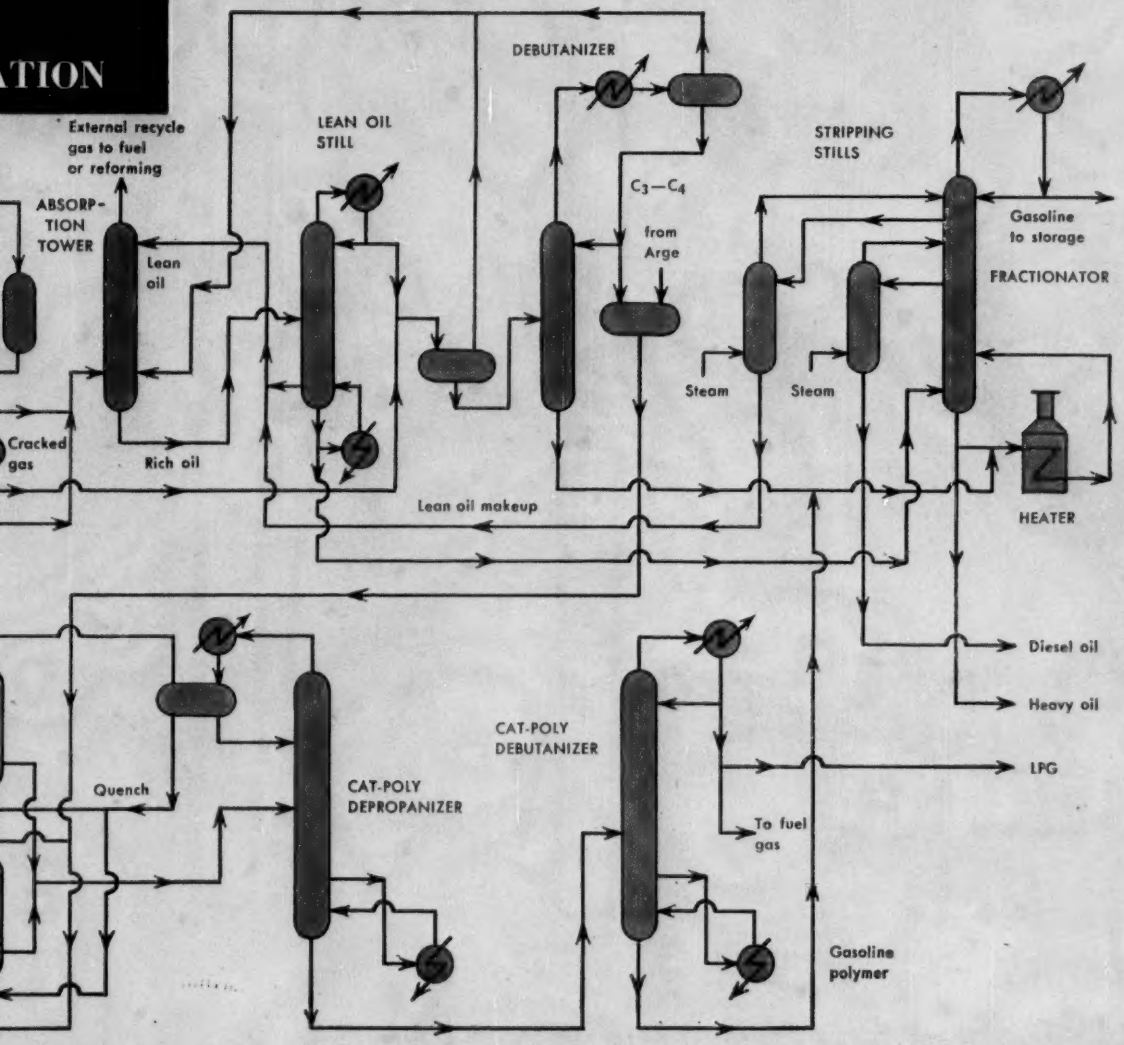
▶**How They Work**—Coal feeds to the top of Lurgi gasifiers through an hydraulically operated pressure valve from a lock hopper. Ash flows from the bottom of the unit through a similar valve.

Steam and oxygen flow to the combustion zone through a rotating grate in the bottom. Temperature in the bottom of the gasifier is about 1,800 F. and is controlled by amounts of steam and oxygen charged. Temperature of the synthesis gas leaving the top of the unit is around 700–800 F. so that the top of the coal bed operates as a precoking section.

▶**Over-All Flowsheet**—The U. S.'s M. W. Kellogg Co. handled the over-all design and construction of the Sasol plant and also played a big part in developing the Synthol version of the Fischer Tropsch process.

Synthesis gas from the Lurgi units passes to a purification plant using a combined Lurgi-Linde process. Parallel trains prepare gas for the Arge and Kellogg synthesis units (Arge synthesis section requires a lower H_2:CO ratio than the Kellogg unit). After purification, gas flowing to the

Separation Units Produce All-Important Gasoline



Kellogg-developed gas reformer analyzes 1.4% N_2, 56.1% H_2, 26.7% CO, 1.5% CO_2 and 14.3% CH_4.

To convert methane to synthesis gas in the reformer, gases preheat in high-temperature heat exchangers and combine with steam and oxygen in special mixing nozzles before passing through the catalyst bed. Temperature at the top of the bed is about 2,000 F. Gas leaving the bottom of the reforming unit has an H_2:CO ratio of 2.0 to 2.8.

► **Gas to Gasoline**—Reformed synthesis gas mixes with recycle gas and feeds to the fluid-bed Synthol reactor operating at 590–650 F. and 250–350 psig. Gas flowing at 4–7 fps. contacts the iron catalyst giving total CO conversions of 95–98%. Over-all carbon utilization is about 88%.

The highly exothermic reaction is controlled in three ways: (1) regulating flow of catalyst to the reactor; (2) controlling quantity of cold gas introduced; (3) transferring heat from the catalyst to the oil cooling system.

Hydrocarbon stream from the synthesis section passes through a purification and catalytic polymerization plant (see above) which produces a stabilized gasoline tailored to the high altitude of the area along with LPG, diesel oil and a heavy waxy oil.

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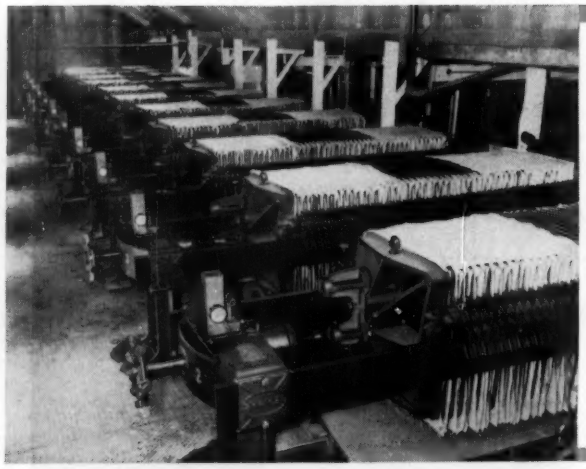
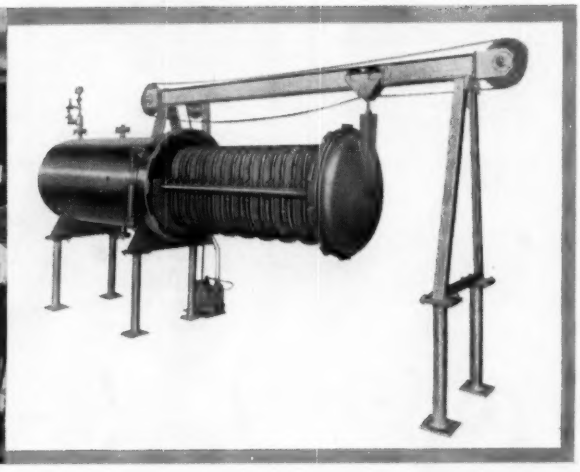
WRITE FOR HANDBOOK ON MULLING

P 660

HOW SHRIVER SELLS FILTRATION NOT THE FILTER





In a Southern sugar refinery processing cane sugar mud, the filter presses had been supplanted by clarifiers and vacuum filters. However, it was found that by this continuous filtration method, too much sucrose was retained in the cake, and the filtrate still contained up to 12% of undesirable solids. This necessitated return to the clarifiers, thereby reducing production. The problem was particularly severe during the rainy season.

Some old filter presses were then put back into service and the sucrose loss was reduced. Better recovery, a higher degree of filtrate clarity and purity, and increased production resulted in greater profit.

Later, 20 additional Shriver filter presses were installed.

A vegetable oil refinery had ordered a Shriver 550 sq. ft., 23 cu. ft. plate and frame filter press for recovery of bleaching clay from vegetable oils. Strange to say, we were not happy about the situation. Our reexamination of this application suggested that a 48" horizontal tank, vertical leaf pressure filter with only 240 sq. ft. of filter area, but with 30 cu. ft. of cake capacity, would produce heavier cakes and would be easier and faster to clean in less down-time.

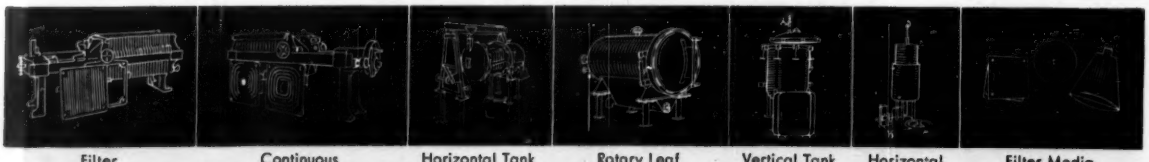
Result: The customer heeded the advice, cancelled the filter press and installed the Shriver leaf filter, with production consequences that more than justified the change in the order.

These are but two examples among many of how the Shriver approach to filtration problems, based on careful technological studies, results in the recommendation of filtration equipment (sometimes not our own) best suited for optimum processing efficiency and economy.

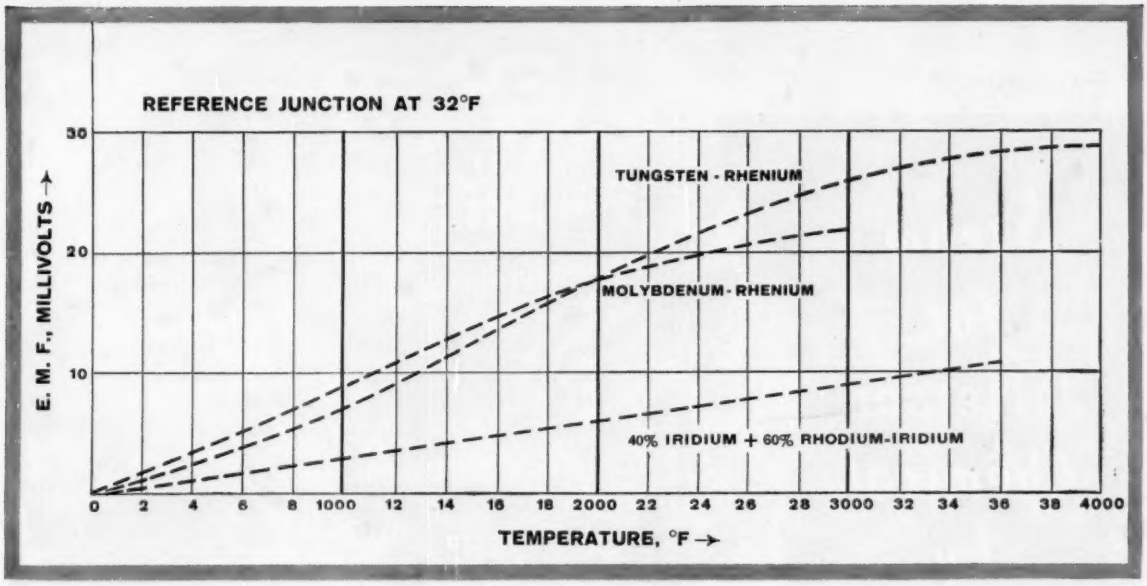
Such unbiased evaluation in your best interest we believe pays off in good will and good business. Let us work with you when you next consider expansion or improvement in your filtration processes.

T. SHRIVER & COMPANY, Inc.

802 HAMILTON STREET, HARRISON, N. J.



Filter Presses | Continuous Filters | Horizontal Tank Leaf Filters | Rotary Leaf Sluicing Filters | Vertical Tank Leaf Filters | Horizontal Plate Filters | Filter Media Textile - Paper


REFERENCE JUNCTION AT 32°F
E. M. F., MILLIVOLTS →
30
20
10
TUNGSTEN - RHENIUM
MOLYBDENUM - RHENIUM
40% IRIDIUM + 60% RHODIUM-IRIDIUM
0 2 4 6 8 1000 12 14 16 18 2000 22 24 26 28 3000 32 34 36 38 4000
TEMPERATURE, °F →

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The thermocouples listed below—tungsten-rhenium, molybdenum-rhenium, and 40% iridium + 60% rhodium-iridium—are the best available combination of calibration stability, reproducibility and physical strength. Although the temperature-emf curves shown above are still tentative, they are based on substantial scientific studies conducted independently in several different laboratories.

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*HIGH TEMPERATURE ASSEMBLIES WITH PROTECTING TUBE**

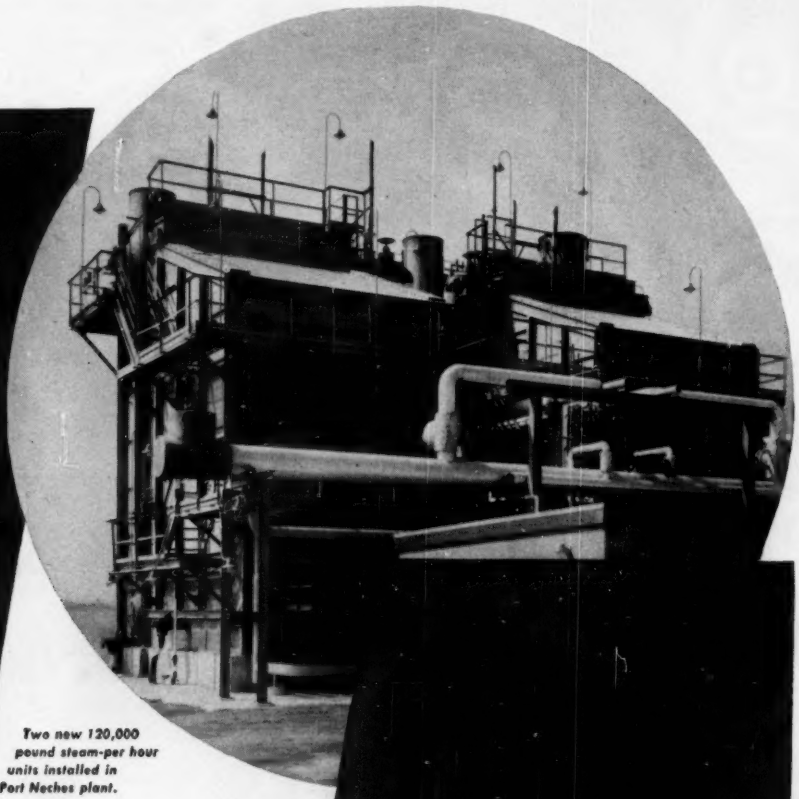
Calibration	Maximum Recommended Temperature	Tube & Insulator Material	Tube Dimensions I.D. (in.)	Tube Dimensions O.D. (in.)
TUNGSTEN-RHENIUM	3200°F	ALUMINUM OXIDE	3/16	5/16
	4000°F	BERYLLIUM OXIDE	1/4	3/8
MOLYBDENUM-RHENIUM	3000°F	ALUMINUM OXIDE	3/16	5/16
40% IRIDIUM+ 60% RHODIUM-IRIDIUM	3200°F	ALUMINUM OXIDE	3/16	5/16
	3600°F	BERYLLIUM OXIDE	1/4	3/8

*HIGH TEMPERATURE ASSEMBLIES WITHOUT PROTECTING TUBE**

Calibration	Maximum Recommended Temperature	Insulator Material	Insulator Dimensions I.D. (in.)	Insulator Dimensions O.D. (in.)
TUNGSTEN-RHENIUM	3200°F	ALUMINUM OXIDE	0.028	0.140
	4000°F	BERYLLIUM OXIDE	0.028	0.130
MOLYBDENUM-RHENIUM	3000°F	ALUMINUM OXIDE	0.028	0.140
40% IRIDIUM+ 60% RHODIUM-IRIDIUM	3200°F	ALUMINUM OXIDE	0.028	0.140
	3600°F	BERYLLIUM OXIDE	0.028	0.130

*Most assemblies available in 5", 11", 17", 20", 23" and 29" immersion lengths.

Steam for Jefferson Chemical by Vogt



Two new 120,000 pound steam-per hour units installed in Port Neches plant.

The needed additional power and process steam capacity for Jefferson Chemical's expanded Port Neches plant is furnished by the two Vogt boilers pictured here, each with a capacity of 120,000 pounds per hour. The boilers are designed for 675 lbs. pressure to operate at 625 lbs. pressure and 769°F. total temperature. The furnaces are equipped with gas burners and have water cooled front and side walls.

Bulletins describing Vogt boiler installations in a variety of industrial plants for power, processing and heating are available on request.

Installation by C. F. Braun and Co., Engineers.

For Custom Installation Bulletin VF-VS-2 • Package Unit Bulletin PSG-3, address Dept. 24A-BC.

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SALES OFFICES: New York, Chicago, Cleveland, Dallas, Camden, N.J., St. Louis, Charleston, W.Va., Cincinnati

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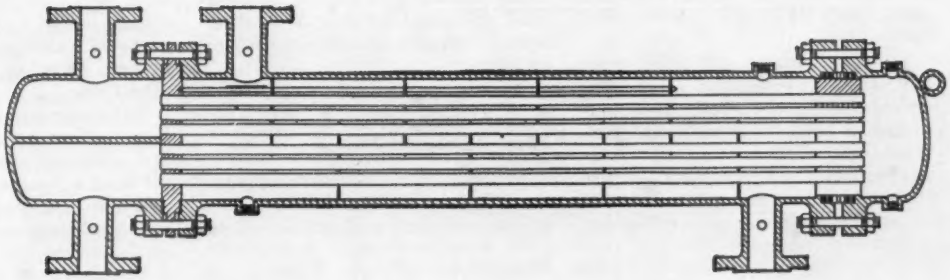
Chemical Engineering
APRIL 18, 1960



New Guide to the Anatomy of . . .

Shell-and-Tube Heat Exchangers

Close examination of the mechanical internals of exchangers lets users benefit from manufacturers' know-how.

C. E. DRAKE and J. R. CARP, The Patterson-Kelley Co., Inc., East Stroudsburg, Pa.

RAPID growth of the process industries over the past 25 years has been accompanied by many improvements and innovations in heat exchanger design.

Today, equipment manufacturers can supply standard or special designs to meet the specifications of virtually any heating, cooling or process application.

But manufacturers can do the best job for you only when they know what you want to accomplish. And you can make the most of their experience and facilities when you have some familiarity with their products and their way of doing business. That is why we are publishing this article—to help remove some of the communication barriers in the selection of heat exchange equipment.

Note that in the discussion that follows we have limited ourselves to heat exchanger designs and components that are basic variations of shell-and-tube exchangers. In shell-and-tube units, heat is exchanged between one fluid flowing through the tubes and another fluid flowing in the space around the tubes within the shell.

There are four basic considerations in choosing a mechanical arrangement that provides for efficient heat transfer between the two fluids while taking care of such practical matters as preventing leakage from one into the other. The four basics are:

1. Consideration for differential thermal expansion of tubes and shell.
2. Means of directing fluid through the tubes.
3. Means of controlling fluid flow through the shell.
4. Consideration for ease of maintenance and servicing.

Heat exchangers have been developed with different approaches to these four fundamental design factors. Three principal types of heat exchangers satisfy these design basics.

Differential Thermal Expansion

Since the fluid in the shell is at a different temperature than the fluid in the tubes, there are corresponding differences in expansion of shell and tubes.

In some cases this temperature difference may be moderate and the differential thermal expansion so small that it is well within conservative stress limits of the materials of construction. However, other times some provision must be made in design to compensate for this difference in thermal expansion.

U-Tube Design—In the U-tube exchanger, differential expansion is taken care of by the shape of the tubes. As the name implies, the tubes have a hairpin shape, with both ends of the tube fastened to one tubesheet. This

U-bend design allows each tube to expand and contract independently.

Fixed Tubesheet—The fixed-tubesheet heat exchanger uses straight tubes secured at both ends into tube-sheets which are firmly welded to the shell.

When a thermal expansion problem exists, an expansion joint is incorporated in the shell. This permits the shell to expand and contract.

Floating-Head Designs — The floating-head exchanger solves the expansion problem by having one stationary tubesheet, and one free to move (float) back and forth as the tubes expand and contract under the influence of temperature changes. The following are four common variations of this design:

In the *floating-head, pull-through bundle* exchanger a separate head or cover is placed over the floating tubesheet within the shell. This floating head is gasketed internally to prevent leakage between the tube side and the shell side.

The *floating-head, outside-packed-lantern-ring* exchanger uses a lantern-ring around the floating tubesheet to seal the two fluids as the floating tubesheet moves back and forth. The lantern-ring is packed on both sides, and is provided with weep holes so that any leakage is open to the atmosphere for ease of detection.

In the *floating-head, split-backing-ring* type the floating-head cover, instead of being bolted directly to the floating tubesheet as in the pull-through type, is bolted to a split backing ring.

The *floating-head, outside-packed-stuffing-box* exchanger uses the outer skirt of the floating tubesheet as part of the floating head.

A packed stuffing box seals the shellside fluid while allowing the floating head to move.

Since the stuffing box is in contact only with the shellside fluid, there is no possibility of leakage mixing with the tubeside fluid.

When the possibility of intermixing of the shellside and tubeside fluids cannot be tolerated, double-tubesheet construction will offer positive assurance against one fluid leaking into the other at a tube-to-tubesheet joint. A second tubesheet is installed with a small space between tubesheets—usually open to the atmosphere.

The double tubesheet can be installed only in the U-tube, fixed-tubesheet and floating-head, outside-packed-stuffing-box exchangers. It is not feasible to use the double tubesheet in the floating-head, pull-through-bundle, floating-head, split-backing-ring or floating-head, outside-packed-lantern-ring exchangers.

Pass Arrangements for Flow Through Tubes

Simplest flow pattern through the tubes is for the fluid to enter at one end and exit at the other. This is a single-pass tubebundle. However, conditions generally do not make a single pass on the tube side a preferred choice.

Increasing flow velocity and turbulence prevent formation of stagnant films of fluid on the tube surfaces. Thus, higher velocities improve the heat transfer rate. This means increasing the number of tubeside passes—that is, directing the flow back and forth through the tubes in the bundle with partitions built into the heads of the exchanger.

There are some limitations on how the different types of heat exchangers can be partitioned to provide various numbers of passes.

With the *U-tube exchanger*, a single pass is not possible because the fluid must traverse the bundle at least twice. Any practical even number of tube passes can be obtained by building partition plates in the front head.

The *fixed-tubesheet* exchanger can be used for any practical number of passes, odd or even. For multipass arrangements, partitions are built into both heads.

With the *floating-head, pull-through-bundle* type any practical even number of passes is possible. For single-pass operation, however, a packed joint must be installed on the floating head.

The *floating-head, outside-packed-lantern-ring* type can be made only single- or two-pass on the tube side.

The *floating-head, split-backing-ring* exchanger is the same as the pull-through-bundle design in the number of tube passes possible. Head partitions can be used to give any practical even number of passes required. However, a special floating-head packed joint is required for single pass.

The *floating-head, outside-packed-stuffing-box* exchanger has no practical tube-pass limitation.

Shellside Fluid Flow

Tubes in heat exchangers are somewhat flexible since they are long and relatively thin-walled. Consequently they must have supports at intervals in the shell to prevent sagging and to minimize vibration.

Tube supports impart some directional effect to shellside flow but are primarily used to support the tubes in a bundle.

Baffles are used to modify shellside conditions so that an optimum coefficient of heat transfer can be achieved. Consider what would happen if there were no baffles in a one-pass shell.

Without baffles, fluid would enter at one end of the shell, distribute itself across the tubebundle and flow slowly—generally parallel to the tubes—to the outlet end. There would be a minimum of "wiping" action against the heat-transfer surfaces. There would also be a tendency to bypass the tubebundle along the path of least resistance. A dead, bypass area can exist in the space between the outer tubes of the bundle and the shell wall.

Flow through a baffled shell is different. Velocity is greater, flow is more turbulent and "wiping" action is increased as the fluid sweeps from side to side or from top to bottom along the tubes. Bypass areas are minimized.

There are a number of different types of baffles and these may be installed in different ways to provide the flow required for a given application.

In general, the selection and location of baffles is a compromise among a number of variables so that the maximum turbulence for increased heat transfer is obtained within allowable pressure-drop limits.

Maintenance and Servicing

Tubesheet arrangements are designed so as to include as many tubes as possible within the shell for maximum heat-transfer surface. Sometimes a layout must be selected which also permits access to the tubes for cleaning as required by process conditions.

Two basic tube arrangements are possible. They are:

- Triangular tube pitch.
- Square tube pitch.

Tubes on a triangular pitch are

packed closely together. In cross-section they form a triangular pattern across the tubebundle. Tubes on a square pitch are somewhat more loosely packed, forming an array of squares in cross-section across the bundle.

The closer pack of the triangular pitch exposes a greater heat-transfer surface to the shellside fluid than the square pitch does, along with greater turbulence and pressure drop. Triangular tube pitch often results in a higher heat-transfer coefficient for these reasons, but this is not necessarily true in all cases.

Square pitch is advantageous where a low shellside pressure drop is a limiting requirement in a given installation.

Close spacing of tubes in triangular pitch has the disadvantage of making the tube exteriors rather inaccessible for mechanical cleaning. It is difficult to insert a rigid tool between the tubes. If a proposed process will produce deposits on the outside of the tubes that cannot be removed by solvent or chemical means, square tube pitch is usually specified. However, this need for mechanical cleaning does not arise in the great majority of heat exchanger applications.

For those cases where triangular pitch tubebundles must be cleaned mechanically, a recent announcement by the Dow Industrial Service Div. of the Dow Chemical Co. describes the successful use of a jet cleaning tool on such bundles. However, the economics of the process are favorable only when several bundles are to be cleaned at the same time.

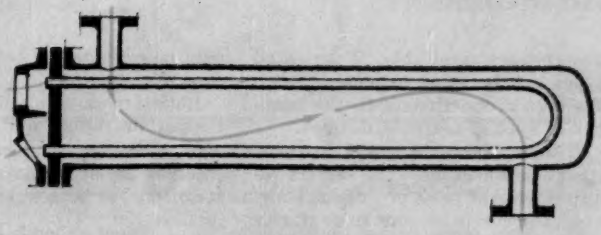
Front and Rear Head Designs

Main components of a heat exchanger are the front head, shell section and rear head. Each of these components is available in a number of standard designs.

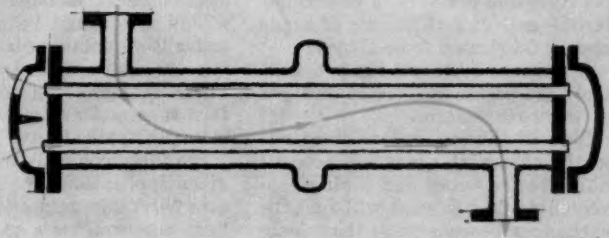
Head designs can vary from plain standard castings to fabricated assemblies with many special features. In many cases, the requirements of an installation may dictate the choice of the more elaborate design. But in others it may be possible to effect savings at no sacrifice in exchanger performance by selecting a readily available or easily fabricated head.

Cast iron heads are the least expensive when patterns for standard

U-tube

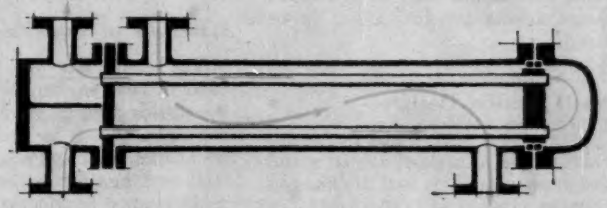


Fixed tubesheet

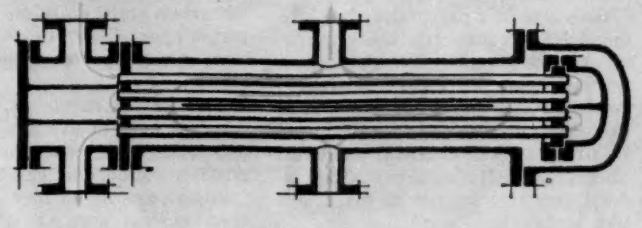


Floating-head, pull-through bundle

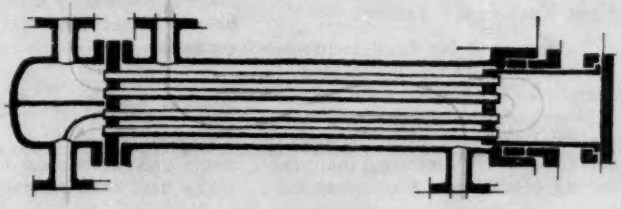
Floating-head, outside-packed lantern ring



Floating-head, split backing ring



Floating-head, outside-packed stuffing box



designs are available. Fabricated types can be more expensive, with the cost proportionate to the number of special features desired.

Either cast iron or fabricated steel heads will meet the service requirements of most processes. However, the corrosive nature or purity requirements of the fluids being handled—or the conditions of temperature and pressure to be encountered—may dictate the use of heads cast or fabricated from alloys.

Partitions built into heads to control tube passes may be of straight or wavy rib design.

Two of the major considerations in the choice of heads are accessibility to the tubes and piping convenience. If a process will foul the exchanger repeatedly so that cleaning is a major factor, a head or cover plate that can be easily removed is an obvious choice. One step in this direction is to locate connections on the sides, not on the ends, of removable heads. The next step is to use a channel.

Open-end heads that are fabricated from cylindrical sections are called channels. These are fitted with easily removable cover plates so that tubes can be cleaned without disturbing piping. They are widely used where fouling conditions are encountered or where frequent access for inspection is desired.

Shell Section Designs

Heat exchanger shells are manufactured in a large range of standard sizes, materials and thicknesses. Smaller sizes are usually fabricated of standard size pipe. Larger sizes are fabricated of plate.

Selection of a particular shell size depends, of course, on the requirements of a given installation. As a working rule at Patterson-Kelley, we find that a more economical heat exchanger can usually be designed by using a small diameter shell and maximum shell length permitted by such practical factors as plant layout, installation, servicing, etc.

Heat Exchanger Tubes

Tubing used for heat exchanger service may either be welded or seamless. The welded tube is rolled into cylindrical shape from strip material and welded automatically under precisely controlled manufacturing conditions. A seamless tube may be extruded or hot-pierced and drawn.

Both are high-quality products. Copper or copper alloys are available only as seamless products, whereas most commercial metals are offered in both welded and seamless.

Tube size is specified by outside diameter and wall thickness. Almost all heat exchanger tubes fall within the range between a $\frac{3}{8}$-in. and a 2-in. outside diameter. Most popular are the $\frac{5}{8}$-in. and $\frac{3}{4}$-in. sizes. These sizes give best all-around performance and are most economical in many applications.

Standards on wall thicknesses for given applications are based on current corrosion data and experience. "Average wall" is a specified thickness which is subject to plus or minus tolerance. "Minimum wall" is a specified thickness which is subject to a plus tolerance only.

Duplex or bimetallic tubes, representing a wide variety of metal combinations, are available and one of these will often be the answer to a specific process problem.

For example, if the metal that the shellside fluid requires is not compatible with the tubeside fluid, a bimetallic tube allows you to satisfy both corrosive conditions.

Materials of Construction

The materials of construction used in heat exchangers depend on the fluids being handled, process conditions, such as pressures, temperatures, etc., and a balance of initial cost against expected life and maintenance requirements.

Any component or the entire unit can be made of any materials such as carbon steel, stainless steel, copper, copper alloys, nickel, nickel alloys, aluminum or other special alloys.

Selection of materials, of course, involves careful evaluation of factors other than the basic cost of possible metals that can be used.

Alloys are much more expensive than carbon steel, but where required, pay off in long service. In place of solid alloy tubesheets, alloy overlay tubesheets may be considered also.

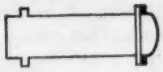
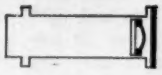
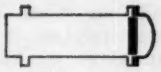
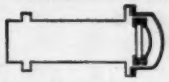
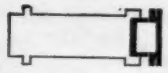
Should Suit Your Needs

Generally speaking, the components and mechanical features that make heat exchangers more elabo-

Mechanical and Economic

Type of design
Relative cost increases from (A) least expensive through (E) most expensive
Provision for differential expansion
Removable bundle?
Replacement bundle possible?
Individual tubes replaceable?
Tube interiors cleanable?
Tube exteriors with triangular pitch cleanable?
Tube exteriors with square pitch cleanable?
Double tubesheet feasible?
Number of tube passes?
Internal gaskets eliminated?

Features of Principal Heat Exchanger Designs

	U-Tube	 Fixed Tubesheet	 Floating-Head, Pull-Through Bundle	 Floating-Head, Outside-Packed Lantern Ring	 Floating-Head, Split Backing Ring	 Floating-Head, Outside-Packed Stuffing Box
	A	B	C	C	D	E
	Individual tubes free to expand.	Expansion joint in shell.	Floating head	Floating head	Floating head	Floating head
	Yes	No	Yes	Yes	Yes	Yes
	Yes	Not practical.	Yes	Yes	Yes	Yes
	Only those in outside row.	Yes	Yes	Yes	Yes	Yes
	Difficult to do mechanically; can do chemically	Yes; mechanically or chemically	Yes; mechanically or chemically	Yes; mechanically or chemically	Yes; mechanically or chemically	Yes; mechanically or chemically
	Chemically only	Chemically only	Chemically only	Chemically only	Chemically only	Chemically only
	Yes; mechanically and chemically	Chemically only	Yes; mechanically or chemically	Yes; mechanically or chemically	Yes; mechanically or chemically	Yes; mechanically or chemically
	Yes	Yes	No	No	No	Yes
	Any practical even number possible.	No practical limitations.	No practical limitations (for single-pass, floating head requires packed joint).	Limited to single- or two-pass.	No practical limitation (for single-pass, floating head requires packed joint).	No practical limitation.
	Yes	Yes	No	Yes	No	Yes

rate and more expensive afford these advantages:

- Accessibility for maintenance.
- Easier tube cleaning.
- Facility of tubebundle replacement.
- Simplicity of piping around the heat exchanger.
- More positive assurance of product separation between tubeside and shellside fluids.

The various basic designs of shell-and-tube heat exchangers were discussed above from a technical and mechanical standpoint. Now, we ought to consider some of the economic factors.

Before comparing the general types of heat exchangers, it might be helpful to point out that the more expensive types do not always yield the best combination of features. For the application you are considering, one of the less complicated types might be ideal in all respects.

It's usually wise to investigate U-tube or fixed-tubesheet construction first. Although they are recommended by their design simplicity and relatively low cost, they are also extremely versatile.

Specific features to accommodate your individual plant circumstances or to satisfy certain demanding maintenance requirements can usually be incorporated in the less costly basic designs. Hence, you get the performance and convenience required without incurring unreasonable costs.

U-tube construction is the least expensive form of heat exchanger. The thermal benefits of using relatively long tubes are attained with a relatively small number of mechanical parts. There is only one tubesheet, and expansion joints are not required.

One of the operating advantages is the ease with which the entire bundle can be removed for maintenance when necessary. A spare tubebundle can be kept at hand for quick replacement if desired.

It is true that internal tube cleaning with mechanical tools cannot be done with the same ease as is the case with straight-tube units. Many exchangers, of course, only require cleaning once or twice in their lifetime. However, in most cases where a fouling fluid must go on the tube side instead of the shell side and where chemical cleaning will not suffice, straight-tube construction would be selected in favor of U-tube design.

Generally speaking, it is most economical to select construction features that permit chemical cleaning of equipment.

Fixed-tubesheet construction of a heat exchanger involves the most straightforward design concept. It is economical. Its cost, while in the same range, may run slightly higher than that of an equivalent U-tube exchanger.

In contrast to the U-tube construction, the fixed-tubesheet design affords complete accessibility to interiors of the straight-through tubes. However, the shell side is inaccessible, and any cleaning it requires must be done by solvent or chemical action.

Replacement of the tubebundle as an operating procedure is not practical. Even as a repair or maintenance measure, it is not economical to replace all tubing. Individual tubes that fail may be replaced or plugged. Normally, plugging a few tubes will not appreciably affect the capacity.

Floating-head construction uses straight tubes, and provision is made for the floating tubesheet to move with thermal changes.

Of the four general types of floating-head exchangers, the pull-through-bundle design is the most economical. It has a rear head that fits inside the shell.

Outside-packed-lantern-ring design provides economic utilization of space inside the shell. It also affords an external check on any leakage at the rear head.

The split-backing-ring design is a variant of the pull-through-bundle type. Clearance to pull the bundle is achieved by the use of a split backing ring at the floating-head joint.

An outside-packed stuffing box allows positive assurance against leakage between shell side and tube side due to packing or gasket failure. And this is the most expensive of the four types of floating-head exchangers.

Consider All the Factors

The economics of heat exchanger selection parallel those involved in choosing other plant equipment. If you deal with a reputable manufacturer, you get what you pay for.

Whether the wisest choice is the least expensive unit that will do the job, or a more costly one that will yield operating savings for years, will depend on a variety of factors. Some of them have been touched on in this article. Others are related to your commercial position, life of your process, expansion possibilities and similar circumstances.

Your heat-exchanger manufacturer stands ready to help you evaluate your short and long term needs. It has been our main purpose here to help you allocate your heat-exchanger dollars to your own best advantage.

CHARLES E. DRAKE has been chief engineer of Patterson-Kelley's heat exchanger division since 1946. A mechanical engineering graduate of Georgia Tech, he is a member of ASME, ASHRAE and a Registered Professional Engineer in Pennsylvania. Drake represents Patterson-Kelley on the ASA committee on heat exchangers for chemical use.

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1960 Inventory of New Plants and Facilities

Nearly 350 major new plants and expansions in the chemical process industries were announced, under way or completed from January 1959 through February 1960

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Total	245	93	

A CHEMICAL ENGINEERING REPORT

New Plants, New Facilities . . .

Who, Where & What

On these pages you'll find who's building what, and where . . . future markets for raw materials and equipment . . . future sources for products.

Tenth in *Chemical Engineering's* inventory of plants and facilities, this report lists 338 projects. They're major new process industry projects announced, under construction or completed in the U. S. from January 1959 through February 1960. No minor projects (less than $200,000) are included.

Listings have been compiled from many sources. They've been checked by *CE* editors for accuracy, completeness and current status.

For projects not included in this report, refer to tabulations of new plants and facilities compiled by *Chemical Engineering* and published annually since 1951. See February 1951, 1952, 1953, January 1954, Inventory issues of 1954, 1955, 1956, 1957 and the regular issue of May 4, 1959.

Atomic Energy

Firm	Location	Products	Dollars	Job Status
Atomic Energy Commission	Hanford, Wash.	Reprocessed nuclear fuels	4.3 million	Plans for 50–150-ton/yr. plant announced late 1959. Will be designed and engineered by Vitro.
Atomic Energy Commission	Oak Ridge, Tenn.	Nuclear fuel	3.5 million	Vitro Engineering awarded contract last year to design nuclear fuel reprocessing plant.
Cottler Corp.	Canon City, Colo.	Uranium ore concentrates (yellow cake)	.....	Expansion from 50 tons/day to 200 tons/day now under way.
Federal Uranium Corp.	Gas Hills District, Wyo.	Uranium ore concentrates (yellow cake)	3 million	522-ton/day mill uses resin-in-pulp process.
Globe Mining Co.	Gas Hills District, Wyo.	Uranium ore concentrates (yellow cake)	3 million	492-ton/day mill uses resin-in-pulp process.
Lucky Mc Uranium Corp.	Fremont County, Wyo.	Uranium ore concentrates (yellow cake)	.....	147-ton/day added capacity brings total to 980-tons/day.
Spencer Chemical Co.	Pittsburg, Kan.	Uranium oxide reactor fuel	.....	50-ton/yr. plant on stream early 1959.
Western Nuclear Corp.	Split Rock, Wyo.	Uranium ore concentrates (yellow cake)	.....	Contract signed with AEC early 1959 to boost capacity from 400 tons/day to 850 tons/day.

Fertilizers

Firm	Location	Products	Dollars	Job Status
American Agricultural Chemical Co.	Cairo, Ohio	Sulfuric acid	.....	Contact process plant scheduled for completion early 1960.
American Agricultural Chemical Co.	Carteret, N. J.	Sodium tripolyphosphate, tetrasodium pyrophosphate	.....	Plant planned as of early 1959.
Best Fertilizer Corp.	Lathrop, Calif.	Ammonia	.....	New plant on stream early 1959 producing 125–130 tons/day.
Bunker Hill Co.	Kellogg, Idaho	Fertilizer	2 million	Phosphoric acid plant under construction.
California Spray Chemical	Kennewick, Wash.	Ammonium nitrate	2 million	Plant on stream late 1959 or early 1960.
Cooperative Farm Chemicals	Lawrence, Kan.	Ammonia, urea, urea nitrate	.....	Capacity increased last fall to 270 tons/day ammonia, 30 tons/day urea, 120 tons/day of nitric acid, 100 tons/day of urea nitrate solutions.

Fertilizers—Continued

Firm	Location	Products	Dollars	Job Status
Davison Chemical Co.	Baltimore, Md.	Superphosphate	.....	New facilities installed mid-1959 can make 100 tons/hr. of superphosphate.
Davison Chemical Co.	Ft. Pierce, Fla.	Granulated fertilizers	500,000	New facilities on stream late last year.
Dow Chemical Co.	Plaequemine, La.	Ammonia, anhydrous and aqueous	.....	Part of a $30-million expansion program, will go on stream late 1961 or early 1962.
Ketona Chemical Corp.	Birmingham, Ala.	Ammonium nitrate, prilled	.....	New plant on stream mid-1959 produces ammonia entirely from coke-oven gas.
Monsanto Chemical	Long Beach, Calif.	Sodium polyphosphate	.....	Plant on stream early 1959.
J R. Simplot Co.	Pocatello, Idaho	Sulfuric acid	.....	200-ton/day plant on stream last year gives firm completely integrated superphosphate operation.
Southern Nitrogen	Savannah, Ga.	Ammonia	.....	Capacity expanded 25% mid-1959.
SunOlin	North Claymont, Del.	Prilled urea	.....	Plant due for completion mid-1960.
Thompson Chemicals Corp.	St. Louis, Mo.	Grain-control chemical	.....	Plant on stream late 1959.
Valley Nitrogen Producer's Cooperative	Helm, Calif.	Anhydrous ammonia, ammonium sulfate, phosphoric acid, ammon um phosphate	.....	150-ton/day ammonia plant on stream late last year, other faci'ities under construction.

Fine Organics

Firm	Location	Products	Dollars	Job Status
Anderson Chemical Co.	Weston, Mich.	Vanadium oxytrichloride	.....	Plant on stream late last year, puts out product as intermediate for olefin-polymerization catalysts.
Baura Chemical Co.	Fieldsboro, N. J.	Citric acid	.....	9,000-ton/yr. unit completed early 1960.
Clintwood Chemical Co.	Chicago, Ill.	Alkanolamides, polyoxyethylene esters	.....	Moving into new plant late 1959.
Crown Zellerbach	Bogalusa, La.	Dimethyl sulfoxide	.....	Plans for 2,500-ton/yr. plant announced late last year.
Miles Chemical Co.	Elkhart, Ind.	Citric acid	3.6 million	Capacity expanded to 7,500 ton/yr. late 1959.
Parke, Davis & Co.	Holland, Mich.	Chloromycetin, other antibiotics	.....	Construction under way mid-1959.
Chas. Pfizer & Co.	Groton, Conn.	Ascorbic acid	.....	Capacity expansion due for completion late this year.
Stauffer Chemical Co.	Henderson, Nev.	p-Chlorothiophenol	.....	Construction plans announced late 1959.

Heavy Organics

Firm	Location	Products	Dollars	Job Status
Allied Chemical Corp.	Buffalo, N. Y.	Maleic anhydride	.....	Plant expansion scheduled for completion by end of 1959.
Allied Chemical Corp.	Moundsville, W. Va.	Maleic anhydride	.....	Plant expansion scheduled for completion by end of 1959.
Air Reduction Chemical Co.	Calvert City, Ky.	Polyvinyl alcohol	.....	20-million-lb./yr. plant on stream early this year.
American Chemical Corp.	Watson, Calif.	Ethyl chloride, ethylene dichloride	7.5 million	Completed early this year.
American Cyanamid	Avondale, La.	Acrylonitrile derivatives	.....	New plant planned.
American Cyanamid	Bound Brook, N. J.	Anthraquinone	Multi-million	Plant completed late last year doubles company's output of chemical.
American Cyanamid	Bridgeville, Pa.	Maleic anhydride	.....	Construction near completion late 1959.
Arizona Chemical Co.	Springhill, La.	Tall oil, fatty acids	5 million	Plant scheduled on stream mid-1960.
Arkansas Louisiana Chemical Corp.	Magnolia, Ark.	Ethane, propane, butane	3 million	New facilities on stream late 1959.
Ashland Oil & Refining	Buffalo, N. Y.	Naphthalene, benzene	.....	New unit, first to commercialize hydrodealkylation process, will turn out either 12 million gal./yr. of benzene or 25,000 tons/yr. of naphthalene.

Heavy Organics—Continued

Firm	Location	Products	Dollars	Job Status
Bay Petroleum Corp.	Chalmetpe, La.	Aromatics	.....	2,000-bbl./day unit due on stream early next year includes reformer, extraction plant, separation facilities.
Borden Chemical Co.	Leominster, Mass.	Polyvinyl alcohol, acrylics, styrene, butadiene	2.5 million	Plant under construction; 5-million-lb./yr. polyvinyl alcohol expansion to be completed mid-1960.
Celanese Corp. of America	Pampa, Tex.	Acetic acid, acetaldehyde	.....	Plant capacity increased to 240 million lb./yr. late 1959.
Cosden Petroleum	Big Spring, Tex.	Ortho-xylene	.....	Capacity will be doubled to 140 million lb./yr. by the end of 1960.
Columbia Gas System, Inc.	Siloam, Ky.	Ethylene	.....	Facilities added in 1959.
Continental Oil Co.	Ponca City, Okla.	Cyclohexane	.....	20-million-gal./yr. plant due for completion Sept. 1960, will use hydrogenation of benzene to cyclohexane. Product is used in making caprolactam for nylon.
Delhi-Taylor Corp.	Corpus Christi, Tex.	Light solvents, heavy aromatic solvents	.....	Construction completed mid-1959.
Dow Badische Chemical Co.	Freeport, Tex.	Acrylic acid; methyl, ethyl, butyl and other acrylic esters	.....	Construction plans announced mid-1959.
Dow Chemical	Longview, Wash. or Portland, Ore.	Phenol	.....	18,000-ton/yr. plant will soon be under construction.
Du Pont	Belle, W. Va.	Methylamines	.....	Plant planned as of Nov. 1959.
El Paso Natural Gas	Odessa, Tex.	Ethylbenzene	.....	Plant on stream mid-1959.
Esso Standard Oil	Baton Rouge, La.	Oxo alcohols	.....	60-million-lb./yr. expansion under construction.
Ferro Chemical Corp.	Bedford, Ohio.	Organic chemicals	.....	Expansion completed mid-1959.
Gulf Oil Corp.	Philadelphia, Pa.	Oxo alcohols, primarily isooctyl and decyl	Multi-million	36-million-lb./yr. plant due on stream mid-1960.
Gulf Oil Corp.	Port Arthur, Tex.	Cyclohexane	.....	New unit on stream early this year.
Humble Oil and Refining Co.	Baytown, Tex.	Phenol	.....	31,000-bbl. plant on stream late 1959.
Jefferson Chemical	Port Neches, Tex.	Ethylene oxide	.....	Plant on stream mid-1959.
Lion Oil Co.	El Dorado, Ark.	Propylene tetramer	.....	New capacity on stream late 1959.
Magnolia Petroleum	Beaumont, Tex.	Ethylene, propylene, butadiene	25 million	380-million-lb./yr. plant will be on stream early 1961.
Monsanto Chemical Co.	St. Louis, Mo.	Maleic anhydride	.....	10,000-ton/yr. plant expansion due for completion this year.
Olin Mathieson Chemical Corp.	Joliet, Ill.	Sulfamic acid	.....	Plans for new capacity announced late 1959.
Olin Mathieson Chemical Corp.	Brandenburg, Ky.	Glycerine, epichlorhydrin, propylene oxide, propylene, glycol ethers, ethylene dichloride, polypropylene glycol	.....	Plans for new facilities announced late 1959. Capacity for propylene oxide and propylene glycol totals 40-million-lb./yr.; plant on stream early 1960.
Phillips Chemical Co.	Sweeny, Tex.	Ethylene	.....	Expansion to 290 million lb./yr. due mid-1960.
Pittsburgh Coke & Chemical Co.	Neville Island, Pa.	Maleic anhydride	.....	1,000-ton/day plant scheduled to start up early next year.
Reichhold Chemicals, Inc.	Elizabeth, N. J.	Maleic anhydride	.....	Construction plans for maleic anhydride announced mid-1959.
Reichhold Chemicals, Inc.	Elizabeth, N. J.	Phthalic anhydride, vinyl acetate	5 million	15,000-ton/yr. phthalic anhydride plant on stream late last year.
Reichhold Chemicals, Inc.	Kansas City, Kan.	Formaldehyde	.....	On stream last year.
Reichhold Chemicals, Inc.	Tuscaloosa, Ala.	Phenol	.....	Capacity will be expanded by 30 million lb./yr.
Reilly Tar & Chemical Co.	Indianapolis, Ind.	Pyridine	.....	Capacity will be doubled by late this year.
Shawnigan Resins	Springfield, Mass.	Polyvinyl alcohol	.....	5-million-lb./yr. expansion completed early this year.
Shell Chemical Co.	Houston, Tex.	Bisphenol-A	.....	Capacity increased by 50% mid-1959.
Shell Chemical Co.	Norco, La.	Glycerine	Over 10 million	30-million-lb./yr. plant on stream late last year.
Standard Oil (Calif.)	Richmond, Calif.	Maleic anhydride	.....	10,000-ton/yr. plant under construction.
Stepan Chemical Co.	Chicago, Ill.	Dimethyl sulfoxide	.....	Plant in full production early 1959.
Sun Oil Co.	Marcus Hook, Pa.	Propylene	2 million	Fractionation facilities completed late 1959.
SunOlin	North Claymont, Del.	Ethylene, ethylene oxide, glycol, polyethylene	15 million	Expansion to nearly 100,000 tons/yr. planned. Sun's Marcus Hook, Pa., refinery will supply dry gas feed.
Texas Butadiene & Chemical Corp.	Channelview, Tex.	Propylene	.....	Plant on stream late 1959.
Union Carbide Chemicals	Texas City, Tex.	Oxo alcohols	.....	60-million-lb./yr. plant on stream early this year.

Inorganics

Firm	Location	Products	Dollars	Job Status
Air Products, Inc.	Chicago, Ill.	Oxygen, nitrogen	.....	100-million-cu. ft./mo. plant on stream early last year for Acme Steel.
Air Products, Inc.	Clairton, Pa.	Oxygen	.....	22-million-cu. ft./mo. plant on stream early 1959 for U. S. Steel.
Air Products, Inc.	Glassmere, Pa.	Oxygen	6 million	150-million-cu. ft./mo. plant on stream 1959.
Air Products, Inc.	New Johnsonville, Tenn.	Oxygen	.....	60-million-cu. ft./mo. plant on stream early 1959 for Du Pont.
Air Products, Inc.	West Palm Beach, Fla.	Liquid hydrogen	.....	On stream late 1959; provides hydrogen fuel for rocket engine tests.
Air Reduction Sales Co.	Baton Rouge, La.	Liquid oxygen, nitrogen argon	2 million	30-ton/day plant on stream this spring.
Air Reduction Sales Co.	Birmingham, Ala.	Oxygen, nitrogen, argon	.....	25-ton/day plant on stream last year.
Air Reduction Sales Co.	Butler, Pa.	Oxygen	.....	120-ton/day plant on stream early this year.
Air Reduction Sales Co.	Fairfield, Ala.	Liquid oxygen	.....	120-ton/day plant under construction, will pipeline oxygen to Tennessee Coal & Iron.
Air Reduction Sales Co.	Kansas City, Kan.	Oxygen, nitrogen, high-purity	.....	New unit completed early last year.
Air Reduction Sales Co.	St. Louis, Mo.	Nitrogen	.....	Capacity tripled last year.
Air Reduction Sales Co.	Wichita, Kan.	Oxygen	.....	Capacity doubled late 1959.
Air Reduction Pacific Co.	Richmond, Calif.	Liquid oxygen, nitrogen, argon	3 million	Construction under way mid-1959. Plant designed for 30-ton/day total production.
American Industrial Chemical Co.	Butler, N. J.	Synthetic magnesium silicate.	.....	Added capacity announced mid-1959.
American Potash & Chemical Corp.	Aberdeen, Miss.	Sodium chlorate	4.3 million	15,000-ton/yr. plant on stream early 1959.
American Potash & Chemical Corp.	Henderson, Nev.	Anhydrous lithium chloride	.....	On stream mid-1959.
Associated Chemicals Co.	Pomona, Calif.	Alum	.....	10,000-ton/yr. plant on stream late last year.
Chemetron Corp.	Gibbstown, N. J.	Carbon dioxide	.....	155-ton/day from ammonia plant byproduct.
Diamond Alkali Co.	Deer Park, Tex.	Chlorine, hydrogen, caustic soda	.....	Operation of expanded facilities begun mid-1959. New capacities are 750 tons/day chlorine, 825 tons/day caustic, and 7.5 million cu. ft./day hydrogen.
Diamond Alkali Co.	Painesville, Ohio	Chlorine, caustic soda	2 million	Modernization completed late last year.
Dixon Chemical Industries	Paulsboro, N. J.	Sulfuric acid	.....	300,000-ton/yr. sludge-burning plant on stream late 1959.
Dow Chemical Co.	Plaquemine, La.	Chlorine, caustic soda	.....	Part of a $30-million expansion program, due on stream late 1961 or early 1962.
Du Pont	La Porte, Tex.	Sulfuric acid	.....	Sludge-acid plant should be on stream late this year, will supply acid to firm's new caprolactam plant under construction at Beaumont, Tex.
Du Pont	Memphis, Tenn.	Chlorine, sodium	Multi-million	Plant on stream early last year, boosting output by 50%. Part of chlorine capacity is used to make titanium pigments at New Johnsonville, Tenn.
Linde Co.	Coatesville, Pa.	Gaseous oxygen	.....	80-million-cu. ft./mo. plant on stream for Lukens Steel May, 1959.
Linde Co.	Duquesne, Pa.	Gaseous oxygen	.....	730-million-cu. ft./mo. plant due on stream mid-1960 for U. S. Steel's four mills in area.
Linde Co.	Ecorse, Mich.	Gaseous oxygen	.....	365-million-cu. ft./mo. plant due on stream June, 1960, for Great Lakes Steel Co.
Linde Co.	Fairless Hills, Pa.	Oxygen, nitrogen	.....	100-million-cu. ft./mo. oxygen, 110-million-cu. ft./mo. nitrogen on stream mid-1960 for U. S. Steel.
Linde Co.	Gary, Ind.	Oxygen, nitrogen	.....	Plant to supply 94-million-cu. ft./mo. of oxygen and 256-million-cu. ft./mo. of nitrogen on stream last month for U. S. Steel.
Linde Co.	Huntsville, Ala.	Liquid oxygen, liquid nitrogen	.....	Plant on stream mid-1960 makes 100-million-cu. ft./mo. of gases.
Linde Co.	Middletown, Ohio	Oxygen	.....	94-million-cu. ft./mo. plant completed mid-1959 for Armco Steel Corp.
Linde Co.	Neosho, Mo.	Liquid oxygen, liquid nitrogen	.....	Plans for 100-million-cu. ft./mo. plant announced late 1959; on stream early 1961.
Linde Co.	New Martinsville, W. Va.	Oxygen, nitrogen	.....	50-ton/day plant completed early 1960, to supply 25-tons/day oxygen to Mobay Chemical's isocyanate plant.
Linde Co.	Pittsburg, Calif.	Liquid oxygen, liquid nitrogen liquid argon	5 million	220-million-cu. ft./mo. plant completed 1959.
Linde Co.	Tonawanda, N. Y.	Liquid hydrogen	.....	25,000-liters/mo. plant on stream late last year.
Linde Co.	Torrance, Calif.	Liquid hydrogen	.....	On stream mid-1960. 12,000-lb./mo. capacity.
Michigan Chemical Corp.	El Dorado, Ark.	Bromine	.....	Capacity due to be doubled by this summer.
Minnesota Mining & Manufacturing Co.	Decatur, Ala.	Fluorine chemicals	4.5 million	Production scheduled to begin early 1961.

Inorganics—Continued

Firm	Location	Products	Dollars	Job Status
Monsanto Chemical Co.	Everett, Mass.	Silica	.....	Expansion completed mid-1959.
National Cylinder Gas	Dallas, Tex.	Liquid oxygen, nitrogen argon	.....	New air-separation plant on stream late 1959.
	Los Angeles, Calif.	Liquid oxygen, nitrogen, argon	1.75 million	35-ton/day plant on stream early last year.
North Star Chemicals	Pine Bend, Minn.	Sulfuric acid	.....	240-ton/day plant on stream late last year.
Olin Mathieson	McIntosh, Ala.	Chlorine, caustic soda	.....	Expansion under way.
Olin Mathieson	Niagara Falls, N. Y.	Chlorine	.....	Plans for expansion announced late 1959.
Socony Mobil Oil Co.	Paulsboro, N. J.	Sulfur	.....	Construction of 100-ton/day recovery unit completed late 1959.
Southwestern Nitrochemicals Corp	Chandler, Ariz.	Anhydrous ammonia	4 million	Construction plans for 80-ton/day plant announced mid-1959.
Spencer Chemical Co.	Vicksburg, Miss.	Argon	.....	Construction plans announced late 1959.
Stauffer Chemical Co.	Delaware City, Del.	Carbon disulfide	.....	New plant, to be built on land purchased from Tidewater Oil, slated for completion this fall.
Stauffer Chemical Co.	Houston, Tex.	Aluminum fluoride	.....	10,000-ton/yr. plant on stream mid-1959.
Stauffer Chemical Co.	Niagara Falls, N. Y.	Chlorine, caustic soda	2 million	Capacity boosted by 25% late last year.
Stauffer Chemical Co.	Vernon, Calif.	Alum	.....	12,000-ton/yr. plant under construction.
Tennessee Eastman Co.	Kingsport, Tenn.	Hydrogen	.....	Plant, designed for 900,000-cu. ft./day, to be completed early 1960.
Union Carbide Metals	Sheffield, Ala.	Calcium carbide	.....	Plans unveiled late last year to convert submerged-arc electric smelting furnace for calcium carbide production. Conversion slated to be completed mid-1960.
Union Carbide Nuclear	Bishop, Calif.	Ammonium paratungstate	.....	Facilities to be completed by end of 1959.
Victor Chemical Works	Chicago, Ill.	Phosphoric acid	.....	Plant to be completed early 1960.
Wesson Oil & Snowdrift Co.	Chicago, Ill.	Hydrogen	.....	Capacity for production by steam reforming of propane increased 20% late last year.
Wyandotte Chemicals	Geismar, La.	Chlorine, caustic soda	25 million	Plant, in full production late 1959, turns out 300 tons/day of chlorine and 330 tons/day of caustic.

Metals

Firm	Location	Products	Dollars	Job Status
Alabama Metallurgical Corp.	Selma, Ala.	Magnesium	3.5 million	New 7,000-ton/yr. plant on stream late 1959.
American Metal Climax	Carteret, N. J.	Germanium	.....	New refinery planned late last year.
American Smelting & Refining Co.	Alton, Ill.	Aluminum alloys	.....	72-million-lb./yr. secondary smelter in operation early 1959.
American Smelting & Refining Co.	Tucson, Ariz.	Copper	40 million	Plans for new plant announced late last year to handle 5.4 million tons/yr. of ore and produce 45,000 tons/yr. of copper.
Duval Sulfur & Potash Co.	Tucson, Ariz.	Copper Ore	20 million	Production, scheduled at 10,000 tons/day, started early 1959.
Kaiser Aluminum & Chemical Corp.	Gramercy, La.	Alumina	70 million	Production began mid-1959.
Reynolds Metals Co.	Massena, N. Y.	Aluminum	88 million	Aluminum reduction plant started up early 1959.
Reynolds Metals Co.	Sheffield, Ala.	Silicon alloy	.....	Construction beginning this summer on 500-ton/yr. plant.
Union Carbide Metals	Niagara Falls, N. Y.	Vanadium, high-purity ductile	.....	Capacity tripled early last year.
Union Carbide Nuclear	Bishop, Calif.	Refined tungsten	.....	Plant expansion scheduled for completion by end of 1959.

Petroleum & Natural Gas Products

Firm	Location	Products	Dollars	Job Status
Arkansas Fuel Oil	Kingsville, Tex.	Natural gas, gas liquids	1.3 million	Plant on stream late last year processes 34,000 Mcfd. of gas, 22,900 gal./day of liquids.
Atlantic Refining Co.	Philadelphia, Pa.	Refined petroleum	4 million	20,000-bbl./day visbreaker revamp completed mid-1959. 2,000-bbl./day crude revamp complete early this year.

Petroleum & Natural Gas Products—Continued

Firm	Location	Products	Dollars	Job Status
Atlantic Refining Co.	Philadelphia, Pa.	Paraffin wax	18 million	265-ton/day plant on stream mid-1959, uses the methyl ethyl ketone solvent dewaxing process.
Aurora Gasoline Co.	Detroit, Mich.	Refined petroleum	.....	18,000-bbl./day vacuum distillation unit completed late 1959; 2,000-bbl./day alkylation unit on stream late 1959; 8,000-bbl./day naphtha Unifiner completed late 1959.
Bay Petroleum Corp.	New Orleans, La.	Refined petroleum	.....	Crude and cat cracking capacity expanded to 35,000 bbl./day and 15,000 bbl./day; alkylation expanded to 2,700 bbl./day early 1960.
Bay Refining Co.	Bay City, Mich.	Refined petroleum	1.8 million	12,000-bbl./day crude distillation unit, 850-bbl./day alkylation unit on stream late 1959.
Century Refining Corp.	Garden City, Kan.	Refined petroleum	.....	3,000-bbl./day cat cracker on stream soon.
Champlin Oil & Refining	Bishop, Tex.	Natural gas, gas liquids	3 million	Capacity expanded by 22,000 Mcfd. last year
CM&M Gas Products Plant, Inc.	Bridgeport, Tex.	Natural gas	750,000	Capacity expanded from 100,000 Mcfd. to 150,000 Mcfd. late last year.
Coastal Products Co.	Corpus Christi, Tex.	Refined petroleum	3 million	7,000-bbl./day fluid coker on stream early this year.
Collier Carbon & Chemical Corp.	Rodeo, Calif.	Carbon black, petrochemicals	.....	Plans for plant announced late last year.
Commerce Oil & Refining	Jamestown, R. I.	Refined petroleum	48 million	43,000-bbl./day refinery planned mid-1959.
Continental Oil Co.	Westlake, La.	Refined petroleum	.....	11,000-bbl./day catalytic reformer completed early this year.
Derby Refining Co.	Wichita, Kan.	Refined petroleum	1.5 million	1,700-bbl./day alkylation unit on stream late 1959.
DX Sunray	Duncan, Okla.	Refined petroleum	1.5 million	5,800-bbl./day MEK dewaxing plant due for completion late this year.
El Paso Natural Gas	Crane, Tex.	Natural gas	2 million	Compression and treating facilities expanded last year.
El Paso Natural Gas	Jal, N. M.	Natural-gas liquids	10.4 million	175,000-Mcfd. gasoline treating facilities on stream late 1959.
Esso Standard	Jamaica, B.W.I.	Petroleum	20 million	Agreement to build refinery signed with Jamaica early 1959.
Farmers Union Central Exchange,	St. Paul, Minn.	Refined petroleum	.....	7,100-bbl./day Unifiner due for completion mid-1960.
General Petroleum	Torrance, Calif.	Refined petroleum	.....	Cat cracker and delayed coker expanded by 8,000 bbl./day and 9,300 bbl./day.
Great Northern Oil Corp.	Pine Bend, Minn.	Refined petroleum	.....	2,000-bbl./day alkylation unit due on stream this summer.
Gulf Oil Corp.	Anascosa County, Tex.	Natural gas	.....	140,000-Mcfd. gas sweetening and dehydration facilities completed last year.
Gulf Oil Corp.	Charleston, S. C.	Refined petroleum	.....	Refinery planned as of late 1959.
Gulf Oil Corp.	Cleves, Ohio	Refined petroleum	.....	11,000-bbl./day distillate treater due on stream this year.
Gulf Oil Corp.	Port Arthur, Tex.	Benzene solvent	.....	Construction completed mid-1959.
Gulf Oil Corp.	Toledo, Ohio	Refined petroleum	.....	16,000-bbl./day distillate treater on stream this year.
Hess Trading & Transport, Inc.	Sewaren, N. J.	Refined petroleum	.....	Crude capacity boosted from 45,000 to 75,000 bbl./day. Adding fluid cat cracker and Udex unit.
Howell Refining Co.	Corpus Christi, Tex.	Refined petroleum	.....	Crude capacity increased from 5,000 to 6,500 bbl./day early this year.
Humble Oil & Refining	Baytown, Tex.	Lubricating oils	.....	New 9,500-bbl/day lube hydrofiner, expanded lube dewaxing and extraction units to be on stream late this year.
Humble Oil & Refining	Kleberg County, Tex.	Natural gas, gas liquids	.....	Cycling plant due on stream late this year will handle 200,000 Mcfd. of natural gas, 28,000 bbl./day of liquid products.
Kerr-McGee	Wynnewood, Okla.	Refined petroleum	.....	25,000-bbl./day crude expansion finished early this year.
Lion Oil Co.	El Dorado, Ark.	Refined petroleum	.....	5,000-bbl./day cat reformer, hydrodesulfurizer, solvent deasphalter on stream late last year. Capacity increases set for cat cracker, alkylation unit, and cat poly unit.
Lone Star Gas Co.	Springtown, Tex.	Natural gas	1.4 million	Capacity boosted late last year from 125,000 Mcfd. to 200,000 Mcfd.
Magnolia Petroleum	Beaumont, Tex.	Refined petroleum	.....	20,000 bbl./day cat reformer due on stream 1960.
McBride Refining	Port Brownsville, Tex.	Refined petroleum	2.5 million	12,500 bbl./day refinery expansion planned.
Natural Gas Liquids Co.	Orange County, Tex.	Gasoline	6.5 million	20,000 bbl./day plant due on stream late 1960 to process natural-gas condensate, natural gasoline and distillate.

Petroleum & Natural Gas Products—Continued

Firm	Location	Products	Dollars	Job Status
Phillips Petroleum Co.	Borger, Tex.	Refined petroleum		25,000-bbl./day cat cracker, on stream by early 1961, will boost Borger cracking capacity to 65,000 bbl./day.
Phillips Petroleum Co.	Kansas City, Kan.	Refined petroleum		6,600-bbl./day alkylation unit on stream early this year.
Phillips Petroleum Co.	Borger, Tex.	Carbon black	Multi-million	Plans for new plant announced late last year.
Richfield Oil Corp.	Everett, Wash.	Refined petroleum	50 million	Refinery planned for probable completion in 1965.
Shamrock Oil & Gas.	Sunray, Tex.	Refined petroleum		8,000-bbl./day Thermofor cat cracker on stream early 1960.
Shell Oil Co.	Deer Park, Tex.	Refined petroleum	3.5 million	30,000-bbl./day distillate hydrotreater due on stream mid-1960.
Shell Oil Co.	Houston, Tex.	Gas liquids	1 million	New facilities due for completion this fall, will boost gas throughput from 110 to 130 million cu. ft./day.
Shell Oil Co.	Norco, La.	Refined petroleum	9 million	$1.2-million cat gasoline fractionator, 16,000-bbl./day Platformer on stream last year.
Shell Oil Co.	Weeks Island Field, La.	Natural gas		120,000 Mcfd. unit on stream late last year.
Shell Oil Co.	Wood River, Ill.	Refined petroleum	15 million	25,000-bbl./day cat reformer due on stream Aug. 1960.
Shell Oil Co.	Wood River, Ill.	Refined petroleum	10 million	Lube oil capacity boosted by 4,000 bbl./day last year.
Signal Oil & Gas.	Huntington Beach, Calif.	Refined petroleum	40 million	40,000-bbl./day refinery under construction.
Sinclair Refining Co.	East Chicago, Ind.	Alkylate, LPG		5,000-bbl./day gas recovery unit and alkylation unit on stream mid-1959.
Sinclair Oil Co.	Marcus Hook, Pa.	Refined petroleum		20,000-bbl./day hydrodesulfurizer on stream late 1959.
Skelly Oil.	El Dorado, Kan.	Refined petroleum		7,000 bbl./day gasoline treater on stream late 1959.
Skelly Oil and Sinclair Oil & Gas.	Eddy County, N. M.	Natural gas, gas liquids		20,000-Mcfd. plant, producing 40,000 gal./day of liquids, due on stream this month.
Standard Oil (Calif.)	Honolulu, Hawaii	Refined petroleum	40 million	35,000-bbl./day refinery due for completion next year.
Standard Oil (Calif.)	Richmond, Calif.	Refined petroleum	33 million	40,000-bbl./day fluid cat cracker on stream 1959.
Standard Oil (Calif.)	Richmond, Calif.	Isobutane		2,000-bbl./day unit isomerizes normal butane, using Universal Oil Products' Butamer process.
Standard Oil (Ind.)	Whiting, Ind.	Refined petroleum		36,000-bbl./day vacuum distillation tower on stream late 1959, cat cracker capacity expanded to 10,000 bbl./day this year.
Standard Oil Co. (Ind.)	Wood River, Ill.	Refined petroleum		30,000-bbl./day cat cracker on stream last year.
Standard Oil Co. (Ohio)	Lima, Ohio	Lube oils, wax	650,000	Plant under construction.
Stauffer Chemical Co.	LeMoyne, Ala.	Purified methane		Construction of new unit started late 1959.
Sun Oil Co.	Laverne, Okla.	Natural gas, gas liquids	4 million	100,000-Mcfd. plant on stream last year.
Sun Oil Co.	Marcus Hook, Pa.	Refined petroleum	1.3 million	15,000-bbl./day furnace oil desulfurizer completed late 1959.
Sunray Mid-Continent.	Port Lavaca, Tex.	Natural gas, gas liquids	600,000	Plant processes 30,000 Mcfd. of gas, 27,000 gal./day of liquids.
Suntide Refining Co.	Corpus Christi, Tex.	Petroleum coke, gasoline, propane, propylenes, butane, butylenes	3 million	7,000-bbl./day delayed coker on stream early this year.
Tennessee Gas Transmission.	Rockport, Tex.	Natural gas, gas liquids		50,000-Mcfd. plant completed late 1959, turns out 45,000 gal./day of gas liquids.
Texaco.	Casper, Wyo.	Refined petroleum		4,500-bbl./day gas oil hydrotreater scheduled for completion late this year.
Texaco.	Lawrenceville, Ill.	Refined petroleum		12,000-bbl./day cat reformer, 12,000-bbl./day hydrotreater on stream late last year.
Texaco.	Port Arthur, Tex.	Refined petroleum		20,000-bbl./day cat reformer, 28,000-bbl./day Udex unit, 1,600-bbl./day alkylation unit on stream late 1959.
Texaco.	Tulsa, Okla.	Alkylate		2,050-bbl./day alkylation unit, 600-bbl./day butane isomerization unit on stream late 1959.
Texas Natural Gasoline Corp.	New Orleans, La.	Natural gas, gas liquids		Plant on stream early 1959, processes 150,000 Mcfd. of natural gas, 380,000 gal./day of liquids.
Tidewater Oil Co.	Houma, La.	Natural gasoline	1.5 million	75,000-Mcfd. gas plant will recover 1,030 bbl./day of propane, butane and natural gasoline. Scheduled on stream late 1960.

Petroleum & Natural Gas Products—Continued

Firm	Location	Products	Dollars	Job Status
Trans-Western Pipe Line Co.	Fort Stockton, Tex.	Natural gas	.....	Treating plant, first in U. S. to use Giammarco-Vetrocoke process, removes carbon dioxide and hydrogen sulfide from 180,000 Mcfd. of natural gas.
Union Oil Co. of Calif.	Wilmington, Calif.	Refined petroleum	25 million	14,000-bbl./day Unifiner-reformer, 20,000-bbl./day mid-barrel Unifiner, 4,000-bbl./day heavy cat Unifiner on stream late this year.
Union Oil Co. of Calif. and Goliad Corp	Vermillion Parish, La.	Natural gasoline	4.5 million	450-million cu. ft./mo. cycling plant under construction.
Warren Petroleum and Sunray Mid-Continent	Forgan, Okla.	Natural gasoline	3 million	100,000-Mcfd. plant on stream late 1959, turns out 100,000 gal./day of liquids.
Wilshire Oil	Norwalk, Calif.	Refined petroleum	.....	HF alkylation unit on stream early this year.
Wilshire Oil	Santa Fe Springs, Calif.	Refined petroleum	.....	1,500-bbl./day alkylation unit on stream spring 1960.

Plastics & Resins

Firm	Location	Products	Dollars	Job Status
Allied Chemical Corp.	Toledo, Ohio.	Phthalate ester plasticizers	.....	New facilities completed early 1959. Size and cost not revealed.
American Chemical Corp.	Watson, Calif.	Vinyl chloride monomer, polyvinyl chloride	.....	Under construction during late 1959.
AviSun Corp.	New Castle, Del.	Polypropylene film	.....	Plant completed late 1959.
AviSun Corp.	Port Reading, N. J.	Polypropylene	.....	20-million-lb./yr. plant on stream mid-1959. AviSun formed by American Viscose and Sun Oil. Facilities leased at Kopper's polyethylene plant.
Borden Chemical Co.	San Francisco, Calif.	Resins, formaldehyde	.....	Construction started late last year on plant to turn out 25,000 tons/yr. of resins and 22,500 tons/yr. of formaldehyde.
Borden Chemical Co.	Illiopolis, Ill.	Polyvinyl acetate, polyvinyl chloride	500,000	Scheduled to go on stream late 1959.
Celanese Plastics Co.	Houston, Tex.	Polyethylene	.....	Capacity expanded to 50 million lb./yr. early this year.
CIBA Products Corp.	Toms River, N. J.	Epichlorhydrin	.....	Plant scheduled for completion mid-1960; will supply intermediate for epoxy resin manufacture.
Cosden Petroleum	Big Spring, Tex.	Styrene	Multi-million	Tripling capacity to 60 million lb./yr. will be completed by early 1961.
Crown Zellerbach	Orange, Tex.	Polyethylene film	.....	Plant in operation mid-1959; capacity is over 16 million lb./yr.
Dow Chemical Co.	Bay City, Mich.	Polypropylene	.....	10-million-lb./yr. plant on stream early 1960.
Dow Chemical Co.	Cleveland, Ohio.	Polystyrene film	.....	Plant on stream early 1959.
Dow Chemical Co.	Freeport, Tex.	Acrylonitrile	.....	35-million-lb./yr. plant planned.
Dow Chemical Co.	Fresno, Calif.	Polyethylene film	2 million	Construction began mid-1959.
Dow Chemical Co.	Placquemine, La.	Polyethylene	.....	Polyethylene facilities due for completion late this year.
Dow Chemical Co.	Placquemine, La.	Vinyl chloride monomer	.....	Part of $30-million expansion program, due on stream late 1961 or early 1962.
Dow Chemical Co.	Torrance, Calif.	Polypropylene	.....	25-million-lb./yr. plant due on stream early 1961.
Du Pont	Florence, S. C.	Polyester film	20 million	New plant on stream early this year doubles firm's capacity for Mylar.
Du Pont	Orange, Tex.	Polyethylene, high-density	.....	Plant using low-pressure process slated on stream mid-1960.
Du Pont	Tecumseh, Kan.	Cellophane	.....	50-million-lb./yr. plant on stream mid-1959.
Du Pont	Victoria, Tex.	Polyethylene	.....	Construction plans announced late 1959.
Ethyl Corp.	Houston, Tex.	Vinyl chloride monomer	.....	New plant scheduled to be on stream early next year.
Ferro Chemical Corp.	Bedford, Ohio.	Vinyl stabilizers	.....	Expansion completed mid-1959.
Foster Grant Co.	Baton Rouge, La.	Styrene	.....	Plant capacity expanded this year from 105 million lb./yr. to 120 million lb./yr.
General Electric Co.	Mt. Vernon, Ind.	Polycarbonate resin	.....	Operation of 10-million-lb./yr. plant to start late 1960.

Plastics & Resins—Continued

Firm	Location	Products	Dollars	Job Status
Goodrich-Gulf	Port Neches, Tex.	Polyethylene, high-density	.....	13-million-lb./yr. plant due on stream late 1960.
Goodyear Tire & Rubber Co.	Point Pleasant, W. Va.	Polyester resins	10 million	Plant completed mid-1959.
Hawaiian Extruders, Inc.	Honolulu, Hawaii	Polyethylene film	.....	Firm, formed by Pacific Chemical & Fertilizer Co. and Dow Chemical Co., is building facilities.
Hercules Powder Co.	Hercules, Calif.	Urea formaldehyde	Multi-million	Expansion slated for completion late 1960.
Hercules Powder Co.	Parlin, N. J.	Polypropylene	.....	Capacity increase to 50 million lb./yr. due in 1960.
Heyden Newport Chemical Corp.	Fords, N. J.	Maleic anhydride, fumaric acid	.....	Construction plans for 12,000-ton/yr. plant announced mid-1959. Plant products are raw materials for alkyd and polyester resins.
Humble Oil & Refining	Baytown, Tex.	Polypropylene	.....	40-million-lb./yr. plant on stream early 1960, can be increased to 100-million-lb./yr.
Mobay Chemical Co.	New Martinsville, W. Va.	Polycarbonate resin	.....	Construction to be completed early 1960.
Mobay Chemical Co.	New Martinsville, W. Va.	Tolyl diisocyanate	.....	3,500-ton/yr. expansion scheduled in addition to 3,000-ton/yr. one previously announced.
Monsanto Chemical	Texas City, Tex.	High-pressure polyethylene	.....	Capacity expanded to 100 million lb./yr. late last year.
Naugatuck Chemical	Painesville, Ohio	Vinyl resin	.....	Expansion to 32,500 tons/yr. now under way.
Nopco Chemical	North Arlington, N. J.	Polyurethane foams	.....	Capacity increased six-fold last year.
Novamont Corp. (Montecatini)	Neal, W. Va.	Isotactic polypropylene	10 million	Construction plans for 5,000-ton/yr. plant announced mid-1959, plant due on stream by mid-1961.
Pacific Carbide and Alloys Co.	Portland, Ore.	Vinyl acetate monomer	.....	Construction of 5-million-lb./yr. plant announced late 1959.
Plastic Horizons, Inc.	Batavia, Ill.	Polyethylene film and tubing	.....	Scheduled to go on stream late 1959.
Reichhold Chemicals, Inc.	Ballardvale, Mass.	Epoxy resins	.....	On stream last year.
Reichhold Chemicals, Inc.	Elizabeth, N. J.	Polyester resin	.....	On stream last year.
Reichhold Chemicals, Inc.	Houston, Tex.	Polyester resin	1 million	On stream mid-1959.
Reichhold Chemicals, Inc	Unannounced	Melamine	.....	Construction to be completed early 1961.
Spencer Chemical Co.	Orange, Tex.	Polyethylene	.....	"Substantial" capacity expansion due for completion this summer.
Texas Eastman	Longview, Tex.	Polypropylene	.....	20-million-lb./yr. plant under construction.
Union Carbide Chemicals	South Charleston, W. Va.	Polyether polyols	.....	Capacity doubled early 1959, because of increasing demand for polyether urethane foams.
Union Carbide Plastics (Visking Div.)	Cartersville, Ga.	Polyethylene film	.....	Plant completed mid-1959.
Union Carbide Plastics Co.	Marietta, Ohio	Epoxy resins	.....	15-million-lb./yr. plant on stream mid-1959.
Union Carbide Plastics Co.	Newark, N. J.	Vinyl foam	.....	Plant expansion, coupled with relocation, announced mid-1959.
Union Carbide Plastics Co.	Seadrift and Texas City, Tex.	Polyethylene	.....	Polyethylene capacity will be boosted by 170 million lb./yr. by 1961.
Union Carbide Plastics Co.	Whiting, Ind.	Polyethylene	.....	72-million-lb./yr. plant under construction.
U. S. Industrial Chemicals	Houston, Tex.	Polyethylene	.....	75-million-lb./yr. plant on stream early 1959. Capacity slated to be doubled by late 1960.

Pulp & Paper

Firm	Location	Products	Dollars	Job Status
Alaska Lumber & Pulp Co.	Sitka, Alaska	Sulfite pulp	60 million	120,000-ton/yr. Japanese-owned pulping plant on stream late last year.
Barcon, Inc.	Appleton, Wis.	Lignin liquor	300,000	New liquor processing plant in production early 1959. Firm is owned by Consolidated Water Power & Paper Co. and Magnet Cove Barium Corp.
Bowater Carolina Corp.	Rock Hill, S. C.	Semi-bleached sulfate pulp, paper	Over 68 million	134,000-ton/yr. sulfate mill on stream late 1959; plans for $30-million paper mill announced at the same time.
Continental Can Co.	Augusta, Ga.	Kraft pulp, paper	.....	350-ton/day bleached sulfate mill under construction.
Crown Zellerbach Corp.	St. Francisville, La.	Pulp and paper	31 million	Plant hit full production early this year.

Pulp & Paper—Continued

Firm	Location	Products	Dollars	Job Status
Fibreboard Paper Products Corp.	San Joaquin, Calif.	Kraft pulp, paper board	Multi-million	Expansion boosts capacity to 72,000 tons/yr. New Fourdrinier kraft machine installed late 1959.
Florida Gulf Fibre Co.	Port St. Joe, Fla.	Paperboard	13.5 million	Plans for semichemical pulping plant announced early this year.
Fraser Paper Ltd.	Madawaska, Me.	Paper	.....	Addition of Fourdrinier machine boosts capacity by 190 tons/day.
Georgia-Pacific Paper Co.	Samoa, Calif.	Pulp, paper	.....	Construction of new mill announced mid-1959.
Georgia-Pacific Paper Co.	Toledo, Ore.	Pulp and paper	10-15 million	Expansion plans, announced mid-1959, will increase capacity to 600 tons/day.
Grays Harbor Pulp & Paper Co.	Hoquiam, Wash.	Paper	10 million	Paper capacity being expanded from 30,000 to 70,000 tons/yr.
International Paper Co.	Camden, Ark.	Clupak extensible paper	.....	New paper machine, third of its kind in U. S. started up mid-1959.
International Paper Co.	Pine Bluff, Ark.	Lightweight paper	13 million	Plans for addition announced mid-1959. Addition will broaden product line at Pine Bluff, formerly limited to newsprint, bleached kraft board.
Menasha Woodenware Corp.	Coos Bay, Ore.	Pulp, Paper	5 million	100-ton/day mill scheduled for completion in 1961.
Nekoosa-Edwards Paper Co.	Nekoosa, Wis.	Paper	.....	Expansion will add 170 tons/day of capacity.
Rome Kraft Co.	Rome, Ga.	Pulp, paper	27 million	500-ton/day expansion will double capacity.
St. Regis Paper Co.	Carthage, N. Y.	Bleached groundwood	2 million	Two-stage bleach plant boosts capacity by 150 tons/day.
St. Regis Paper Co.	Tacoma, Wash.	Kraft pulp, paper	28.5 million	Capacity being doubled; 400-ton/day paper machine being installed; completion set for next year.
Scott Paper Co.	Mobile, Ala.	Pulp, paper	10 million	Expansion from 170,000 to 240,000 tons/yr. under way.
Southwest Forest Industries, Inc.	Snowflake Area, Ariz.	Pulp and paper	40 million	Plant plans announced early this year.
Tennessee River Pulp & Paper	Counce, Tenn.	Kraft pulp, paperboard	40 million	500-ton/day mill scheduled to be completed early 1961.

Rubber

Firm	Location	Products	Dollars	Job Status
Borden Chemical Co.	Illiopolis, Ill.	Butadiene-styrene emulsions	500,000	Scheduled to go on stream late 1959.
Dow Chemical Co.	Allyn's Point, Conn.	Styrene-butadiene latex	.....	New plant will be built by early 1961.
Dow Chemical Co.	Freeport, Tex.	Styrene-butadiene latex	.....	Expansion completed this year.
Esso Standard	Baton Rouge, La.	Butyl rubber	16 million	Refinery expansion to increase butyl rubber output by 38,000 tons/yr.
Firestone Tire & Rubber Co.	Orange, Tex.	Polybutadiene, polyisoprene	.....	30,000-ton/yr. plant scheduled to be on stream late this year or early next year. Will first produce polybutadiene, may later switch to polyisoprene.
General Tire & Rubber Co.	Mogadore, Ohio	Styrene-butadiene latices	350,000	Expansion of facilities completed mid-1959.
Goodrich-Gulf Chemical Co.	Port Neches, Tex.	Synthetic rubber	1.3 million	15-million-lb./mo. plant on stream early 1959.
Shell Chemical	Torrance, Calif.	Polyisoprene, isoprene	.....	15-20,000-ton/yr. plant in full production early next year. Also facilities to make isopentane for conversion to isoprene.

Synthetic Fibers

Firm	Location	Products	Dollars	Job Status
Allied Chemical Corp.	Hopewell, Va.	Nylon-6	.....	Expanding capacity to about 75 million lb./yr. by mid-1961.
Beaunit Mills, Inc.	Elizabethton, Tenn.	Polyester fiber	.....	Plant, designed for 10-million-lb./yr. production, started up mid-1959.
Dow Chemical	Williamsburg, Va.	Nylon-6	.....	12-million-lb./yr. plant scheduled on stream early 1961, to make nylon-6 for tire cord.
Du Pont	Beaumont, Tex.	Caprolactam	.....	25,000-ton/yr. plant to go on stream by end of 1960; product is intermediate for nylon-6 manufacture.

Synthetic Fibers—Continued

Firm	Location	Products	Dollars	Job Status
Firestone Tire & Rubber Co.	Hopewell, Va.	Nylon-6	.....	12-million-lb./yr. plant should be on stream late this year, will supply 15% of Firestone's nylon tire cord needs.
Standard Oil (Ohio)	Lima, Ohio	Acrylonitrile	Multi-million	Plant scheduled for completion early this year. Uses propylene and ammonia as raw materials

Miscellaneous

Firm	Location	Products	Dollars	Job Status
Allied Chemical Corp. (Barrett Div.)	Edgewater, N. J.	Gypsum	.....	900-ton/day calcining plant built in late 1959.
American Gilsonite Co.	Grand Junction, Colo.	Hydrocarbon crudes	.....	Coking capacity expanded from 700 tons/day to 1,100 tons/day.
American Potash & Chemical	Trona, Calif.	Boric oxide	800,000	Construction started late 1959.
Arizona Chemical Co.	Springhill, La.	Tall oil	.....	40,000-ton/yr. refinery due on stream this summer.
Calaveras Cement Co.	Redding, Calif.	Cement	14 million	1.5-million-bbl./yr. plant scheduled for completion early next year.
Cargill, Inc.	Norfolk, Va.	Soybean oil, meal	.....	New solvent-extraction plant turns out 10 million gal./yr. of oil and 170,000 tons/yr. of meal.
Columbia Southern	Barberton, Ohio	Cement	.....	1.5-million-bbl./yr. plant on stream late 1959.
Continental Carbon Co.	Lake Charles, La.	Carbon black	.....	Capacity increased from 45 million to 70 million lb./yr.
Department of Interior	San Diego, Calif. (Point Loma)	Fresh water	.....	1-million-gal./day salinewater conversion plant uses multistage flash distillation, scheduled on stream this year.
Ethyl Corp.	Orangeburg, S. C.	Methyl, ethyl, isobutylaluminums, ethyl and methyl aluminum halides	.....	Expansion completed late last year.
Flintkote Co.	Dolomite, Utah	Lime	1 million	New plant on stream late last year.
High Energy Fuels, Inc.	Columbus, Miss.	Ammonium perchlorate	.....	4-million-lb./yr. plant in operation mid-1959. Product to be used as oxidizer material for solid-fuel rockets, missiles.
Idaho Potato Starch Co.	Blackfoot, Idaho	Starch	.....	Construction plans announced mid-1959. Plant will handle 300 tons/day of potato feed.
Kaiser Aluminum & Chemical	Purvis, Miss.	Carbon, anode-grade	500,000	70,000-ton/yr. coke calcining plant on stream late last year.
Kaiser Aluminum & Chemical	Columbiana, Ohio	Basic refractory brick	750,000	Expansion completed last year.
Kaiser Aluminum & Chemical	Midland, Mich.	Refractory magnesia	3 million	45,000-ton/yr. plant in operation early this year.
Monsanto Chemical	Nitro, W. Va.	Mersize chemically modified pale rosin size	.....	Plant on stream early 1959.
Norton Co.	Worcester, Mass.	Alumina and zirconia refractories	.....	Facilities expanded last year.
Pacific Engineering & Production Co.	Henderson, Nev.	Ammonium chlorate	.....	Plant in production last year, using "modified electrolytic process."
Penn-Olin Chemical Co.	Calvert City, Ky.	Sodium chlorate, other chlorates	6.5 million	25,000-ton/yr. plant under construction; Penn-Olin owned by Pennsalt Chemicals and Olin Mathieson.
Pennsalt Chemicals	Portland, Ore.	Ammonium perchlorate	2 million	Capacity increased by "several thousand" tons/yr. late last year.
Permanente Cement Co.	Oahu, Hawaii, Waianae area	Cement	12 million	1.7-million-bbl./yr. plant due on stream Aug. 1960.
Pittsburgh Coke & Chemical	Neville Island, Pa.	Activated carbon	800,000	Expansion of facilities during late 1959.
Pittsburgh Plate Glass	Shelby, N. C.	Fiber glass yarn	.....	18,750-ton/yr. plant under construction.
J. R. Simplot Co.	Bovill, Idaho	Clay, silica	2 million	New plant, operating on kaolin clay feed, on stream late last year.
Texas Alkyls	Houston, Tex.	Aluminum trialkyls, other alkyls	.....	2-million-lb./yr. plant on stream early this year. Texas Alkyls formed by Hercules Powder and Stauffer Chemical.
Texas Industries, Inc.	Midlothian, Tex.	Cement	14 million	1.4-million-bbl./yr. plant began construction late last year.

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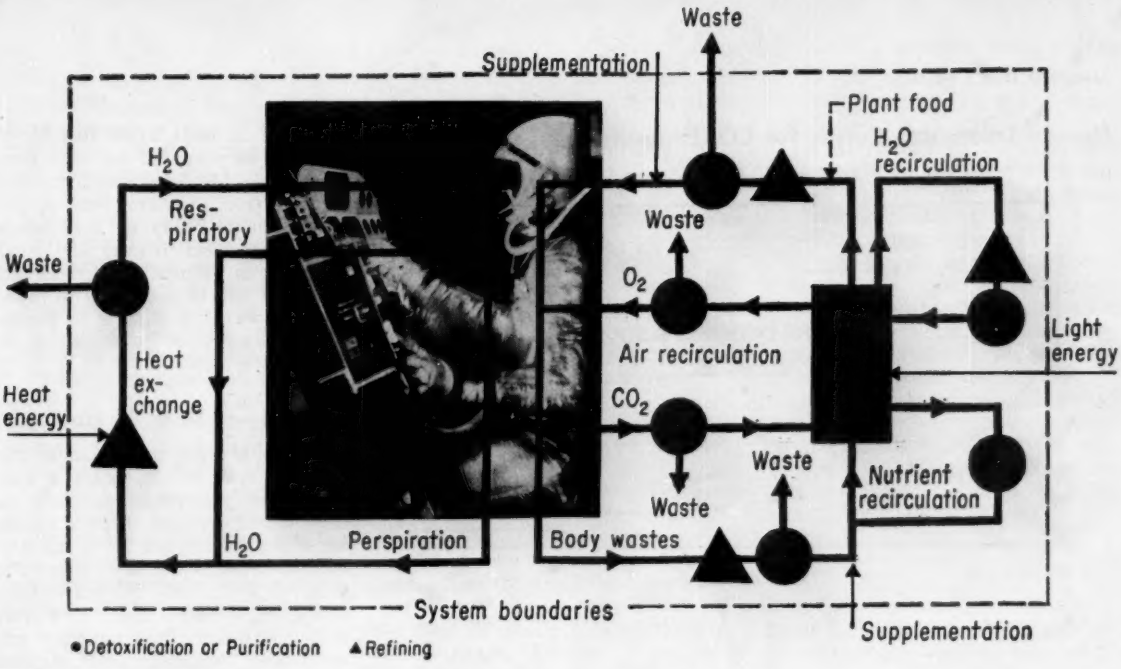


Chemical Engineering Problems of . . .

Keeping Men Alive in Space Rockets

Problems of keeping space travelers fed and free of toxic wastes are not unlike many process problems—except the travelers are part of the flowsheet. A key to manned space probes: photosynthetic gas exchangers.

A. E. HUMPHREY and F. H. DEINDOERFER, Univ. of Pennsylvania, Phila., Pa.

RECENTLY, chemical engineers have turned their talents to many new technologies—nuclear reactors, fuel cells, propulsion, convenience foods and chemotherapeutic agents. Of these, the biological processes for production of food and therapeutic agents have a particularly bright and interesting future. For space travel—not too far in the future—will be impossible without some type of system for maintaining mass cultures of living cell tissues which will fit into the closed-cycle environment of a space rocket.

We intend to discuss some aspects of these problems. Not surprisingly, many are going to be solved by the application of chemical-engineering principles.

Mass culture of tissue (plant or animal) and closed-cycle environments can be thought of as two different technologies. However, they are not completely separate. Any success achieved in design and operation of a long-term closed-cycle environment will depend upon whether a particular tissue culture or set of cultures can provide air, food and waste-disposal environs required for survival.

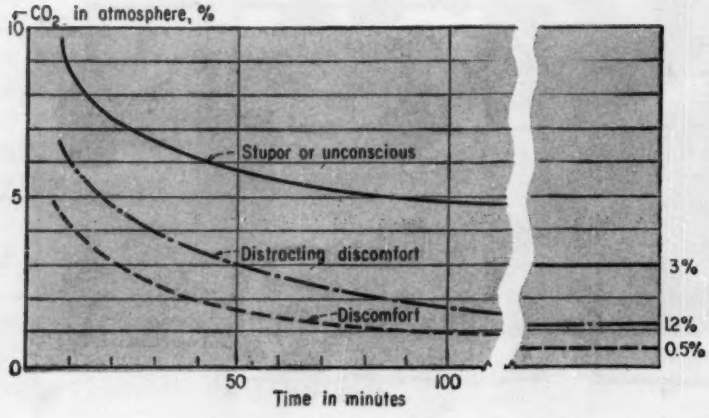
Define Food and Closed Cycle

Before going further, it is necessary to define what we mean by food and by closed-cycle systems. In this article, food shall refer to anything man ingests or inhales to maintain his well being. This includes O_2, H_2O, therapeutic agents and solid nourishment.

A closed-cycle system is a physical volume essentially isolated from all mass and energy exchange with sources outside the system. It is capable of supporting life, generally the human form, for a finite period of time. The period of operation of this system may be several hours for a brief space probe, or up to many years in the case of colonizing a lunar or planetary space station.

Actually, there can never be a

Human Tolerances Curves for CO_2 Exposure[6]



truly isolated system. Any space traveler and his vehicle will continually be hit by cosmic particles and by light photons from the sun and distance stars. In addition, any system will erode in the virtual vacuum of space, will leak gases, will eliminate some wastes to the universe.

Trip to the Moon

Now let's look at a system designed for a two-week trip to the moon and back by two men. To listen to some space-travel experts the problems are simple. Man requires 3,615 grams or roughly 8 lb. of food material/day. Multiplying by two men and by seven days gives 112 lb. Double this to allow for the weight of equipment to contain water and oxygen and we have 224 lb. Since roughly 160 to 1,000 lb. of rocket motor is required to place 1 lb. of satellite in orbit, only around 20 to 100 tons of rocket motor is necessary to handle the requirements of man on this trip to the moon. Existing and projected rocket motors are many times this size. But the problem is not so simple.

You may well ask about CO_2 accumulation. Isn't there a limit to which man can be exposed? What about perspired and respired water? Are we going to let it accumulate until the humidity reaches 100%? What about removal of fecal and urinary wastes; and hydrogen, methane and hydrogen sulfide gases that man eliminates?

Closed-Cycle Problems

Let's take a look at some of these problems in greater detail. A man exhales around 840 grams or 16.5 cu. ft. of CO_2 (25 C. and 1 atmo.) every 24 hr.

The curves (see above) illustrate man's tolerance to CO_2 exposure. A man in 100 cu. ft. of space (roughly that in the Project Mercury capsule) would, unless CO_2 is continuously removed from this space, receive a toxic exposure within 4½ hr. Obviously CO_2 must be absorbed or the gaseous environment must be completely replenished every 40 min. if our space traveler is to suffer no discomfort or toxic effects.

Next let's look at the heat problem. A man on a 2,400 Kcal. diet will eliminate much of this food energy as sensible heat in exhaled gases and as latent heat in respired and perspired water. This is roughly equivalent to 9,500 Btu./day/man. Since the temperature conditions encountered in space travel will be so variable, it's likely the closed-cycle system will be thermally insulated and internally generated heat must be removed mechanically.

A normal man eliminates around 2,400 grams of water/day, of which approximately half is respired and perspired water. Through respiration and perspiration a man would saturate 100 cu. ft. of enclosed dry air at 25 C. and 1 atm. in 30 min. To remove this water by condensation represents a refrigeration capacity of at least 3,000 Btu./day/man. To be prepared for high perspiration rates from great psychological stress, the water removal capacity should really be four times this. To prevent urinary and fecal water from saturating this closed system it will be necessary to process such water, placing it in a gastight chamber or eliminating it from the system.

Toxic Gases Must Be Handled

Flatus, the gas generated in the stomach and bowels, poses a real toxic and hazardous problem in small closed systems. Typical values based on an average 2,100 ml./day of human flatus would be about 9% CO_2, 3.9% O_2, 59% N_2, 7.2% CH_4, 20.9% H_2, 0.0003% H_2S[8]. However, both the quality and quantity are extremely variable and depend largely upon diet and stress conditions. Because these gases pose such hazardous possibilities, high factors of safety seem necessary when designing a closed-cycle system.

Two men would, under normal diet and no stress conditions, generate ½ cu. ft./week of pure CH_4 and H_2 gas. At this rate the explosive limit of around 4% in 200 cu. ft. of closed space filled with air would be reached in 112 days. Our moon travelers, if they remain normal, suffer no stress or strain and were breathing air, would not require a system to eliminate these explosive flatus gases. But most likely our astronauts will be under strain and will probably be breathing an enriched O_2 atmosphere. What will be the hazards of flatus gas in such conditions? Is a safety factor of 15 sufficient? These questions need to be answered before any flight to the moon. Probably, the manned moon rocket will have an alarm system for the flatus gases and either a small refining system to eliminate them or a technique to flush them out with emergency air (not O_2).

Table I indicates current thinking at the USAF School of Aviation Medicine regarding toxic hazards of flatus gases. The figures can be questioned as they represent normal conditions with normal individuals. Safety engineers usually design a system for abnormal situations.

Obviously, solutions to all these problems will require weight and space.

How would a two-man, seven-day,

closed-cycle system be designed? It must provide a supply of water, dehydrated food, gaseous oxygen and emergency flushing air; a mechanical disposal system for removing fecal and urinary wastes; a mechanical refrigeration system for removing heat, and respired and perspired water; a gas-processing system for stripping out H_2, CH_4, H_2S and CO_2 from the gaseous environment of the system.

There are an almost unlimited variety of possible closed-cycle systems. The design will depend upon volume, weight, time and capacity requirements of the system.

Table II is a guesstimate of how some design parameters will be combined in a short-term (less than two weeks) and in a long-term (greater than one year) closed-cycle system. In one, we are referring to satellite and moon trips; in the other, planetary space flight.

The drawing on p. 183 is a process flow diagram as a chemical engineer might envision it of an intermediate time (several years) closed-cycle system.

Mass Food Production

Successful design and operation of a long-term closed-cycle system will largely depend on development of techniques for mass cultivation of food tissue. Biological systems must be available which will reasonably balance out the ecology between man and his supporting system.

By mass tissue culture we mean the pure or mixed cultivation of plant or animal cells on a large scale in an artificial state, starting from individual cell strains. The state is artificial because initial cells for the culture are taken from their natural environment and placed in an artificial one by man. However, the new environment, through adaptation and mutation, may become a natural one for the subsequent acclimated cells.

In the definition of mass tissue culture, the phrase "individual cell strains" indicates that all cells have as a common ancestry a single cell originally isolated from its natural habitat.

Tissue, mass cultivated on a large scale (20 liters), include cells such as rabbit kidney and carrot root. Cell types cultivated on a small scale range from embryonic chick beaks to bovine udder tissue.

However bright the future may be for closed-cycle systems through use of mass tissue culture, obviously, mass tissue culture will not be used to totally balance the system ecology. At some point supplementation from the earth will be easier and cheaper than increasing complexity of a closed-cycle space system.

Photosynthetic Equipment

This might be a good point to consider the major problems of the immediate future in designing closed-cycle systems for space flight:

- Minimization of psychological stress.
- Recycle systems for water.
- Carbon dioxide absorption.
- Oxygen regeneration.
- Acceptable food generation and supplementation.
- Elimination or utilization of wastes.
- Elimination of toxic and hazardous gases.
- Elimination of other toxic metabolites.
- Minimization of systems from weight and volume viewpoints.
- Generation and supplementation of therapeutic agents.
- Efficient energy sources.

Development of an efficient photosynthetic gas exchanger should provide complete or partial solutions to a number of these problems. In such an exchanger, the catalytic action of chlorophyll in plants converts light energy into the chemical energy of cellular tissue. This energy reduces carbon dioxide, oxidizes water and gives off oxygen as a byproduct of the reaction. The over-all reaction is:

$$6CO_2 + 6H_2O \xrightarrow[\text{light energy}]{\text{chlorophyll}} C_6H_{12}O_6 + 6O_2$$

These exchangers present a number of interesting engineering problems:

- Choice of efficient plant species.
- Efficient mass transfer with plant culture.
- Elimination of toxic materials in gas streams.
- Efficient utilization of light.
- Maximization of exchange from a weight and volume viewpoint.
- Continuous, automatic control of system.
- Containment of system (materials of construction).
- Stabilization of system through aseptic techniques.
- Utilization of fecal and urinary wastes.
- Minimization of water loss from system.
- Regulation of system temperature.
- Harvest or removal of cells.
- Operation under conditions of low and high gravity.

Selection of an efficient plant species can be likened to choosing an efficient synthesis route for a chemical product. Some give better yields, require fewer steps and involve less complex equipment. A number of plants receiving a considerable amount of study are from *Chlorella* species, a variety of green algae. Unfortunately these plants have relatively low metabolic rates, calling for large exchanger equipment.[2, 3]

Because of their higher metabolic rates, thermophilic algae, which grow at temperatures above 39 C.

and at higher light intensities, produce greater gas exchange rates.[4] Several members of the common blue-green algae have been studied recently and show much promise. It is not impossible that plants other than algae (such as mountain heather) may be used for gas exchange.[3]

Since light exposure for photosynthesis need only be intermittent, it may be possible to increase the concentration of algae in a gas exchanger and consequently reduce the size of equipment by promoting tubulence through forced circulation. If light intensity becomes too great, heat removal becomes a problem. The chlorophyll in any algae has an adsorption band of 4,000 to 7,500 Angstroms.[4] If irradiated with broad spectrum light, the infrared radiation above 7,500 Angstroms will be absorbed as heat by the water. If sunlight is used, it's been estimated that only 20% of the incident spectral energy will be absorbed for photosynthesis.[5]

Very small but detectable concentrations of deadly CO have been detected in experimental algae closed systems. Obviously, some method of CO removal is mandatory, lest it cause a lethal exposure. Catalytic oxidation to CO_2 has been employed in some small-scale experimental studies.[5]

Some very interesting equipment design problems arise when considering photosynthetic gas exchangers. For instance, how do we handle gas exchange in gravity-free environs? One novel solution involves exchanging the gas across a semipermeable membrane.[4] Algal culture is circulated by forced convection on one side of the membrane. Carbon dioxide from the air permeates the membrane and goes into the algal suspension, oxygen permeates it in the opposite direction, because of differences in concentration driving forces. Reported permeabilities for various membranes are such that this mass-transfer step should not be a limiting one at the currently achievable gas exchange rates. However, if more efficient plant-culture systems are developed, the membrane transfer step may eventually become a real problem.

Other interesting engineering problems of the gas exchanger: eliminating cell clumping, and keeping illuminating surfaces clean and transparent. If the gas is sparged into the algal suspensions, rather than permeated across a membrane, foaming problems may have to be eliminated or minimized for efficient operation.

Another particularly important problem is prevention of infection of a plant culture in a closed system by undesirable contaminants. Aseptic processing will undoubtedly be required. All streams entering will have to be sterilized. Food harvesting methods will be needed which will not contaminate the system. The techniques will be similar to those used in producing chemicals via fermentation.

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F. H. Deindoerfer

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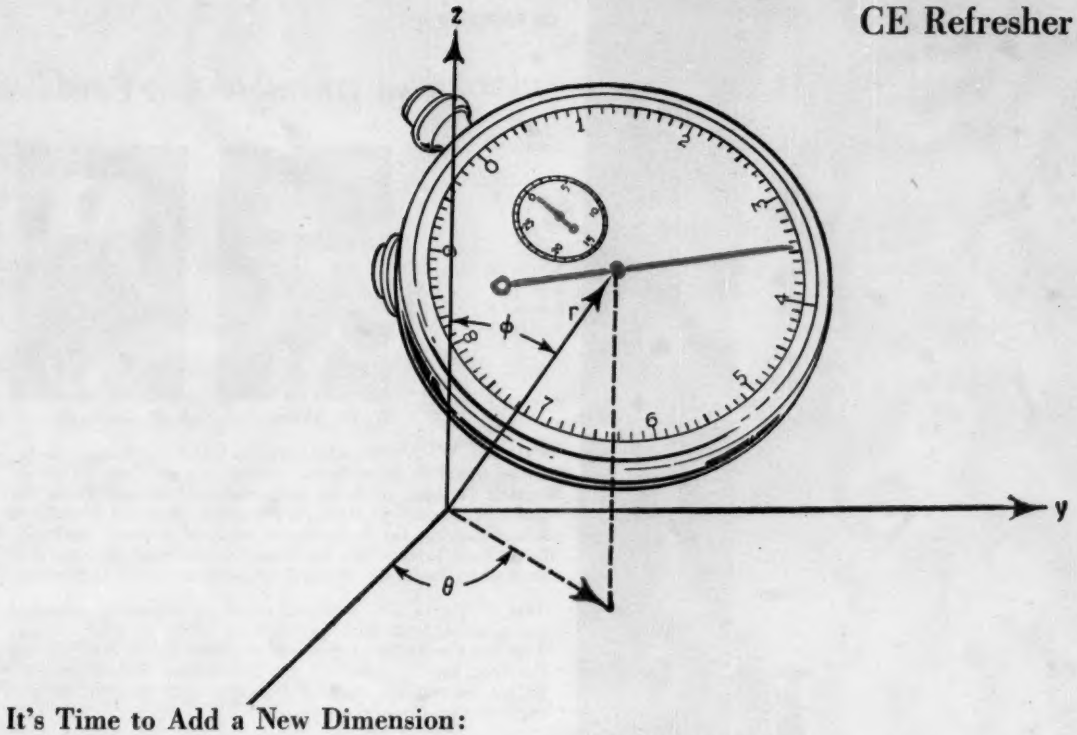


It's Time to Add a New Dimension:

Unsteady-State Heat Transfer—I

Thermal design engineers now say, "The steady state is obsolete." Here's a chance to modernize your knowledge of heat transfer.

SAM H. DAVIS, JR. and WILLIAM W. AKERS, Rice Institute, Houston, Tex.

INCREASING use of control systems in chemical process operations makes it more important than ever that the chemical engineer have a working knowledge of dynamic response in the processes which he designs Since temperature is one process variable that is often controlled, a knowledge of unsteady-state heat transfer has become a necessity for the thermal design engineer.

Other problems that require a knowledge of unsteady-state heat transfer include the start-up behavior of heat exchangers, reactors or similar equipment; and the response of such equipment to changes in operating conditions.

Analysis of unsteady-state heat transfer is based on applications of the first law of thermodynamics. The behavior of a system which has variables that depend only on time can be described by ordinary differential equations derived from mass and energy balances around the system. We'll consider such systems in this section of your CE Refresher series.

In cases where the temperature or other variables depend on position as well as time, partial differential equations must be used to describe the response of the system. Solutions of this kind will be discussed in succeeding articles, now scheduled for publication in early issues of *Chemical Engineering*.

Start With an Energy Balance

The energy balance for any system consisting of a fixed mass can be expressed this way:

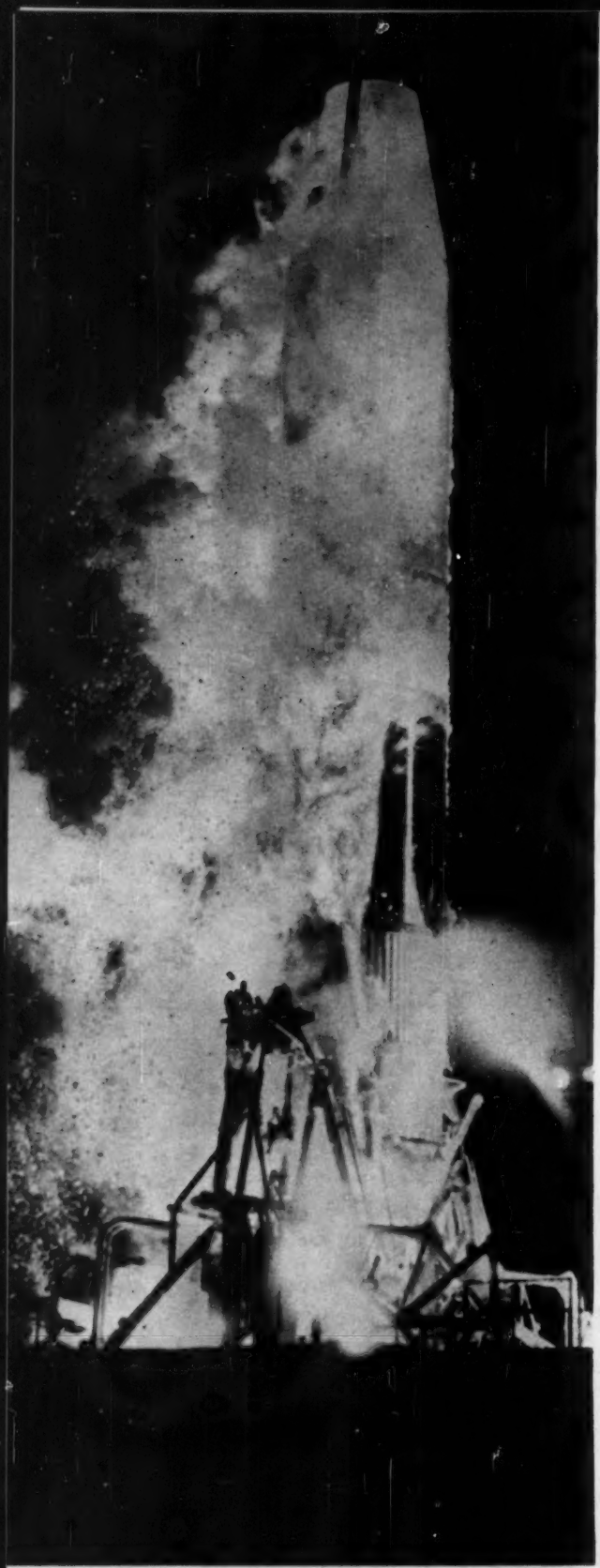
$$E_1 - E_o = Q - W \qquad (1)$$

where E_1 is the final total energy of the system (internal, kinetic and potential energy); E_o is the initial total energy of the system; Q is the heat absorbed by the system from the surroundings between the initial and final conditions; and W is the work done by the system on the surroundings between the initial and final conditions.

If we differentiate Eq. (1) with respect to time, we obtain:

$$dE/dt = q - w \qquad (2)$$

where E is the instantaneous total energy of the system; q is the instantaneous rate of absorption of heat by the system from the surroundings; and w is the



SPACE-AGE heat transfer makes time an important variable in the equation. The steady state is obsolete.

CE REFRESHER . . .

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WILLIAM W. AKERS was born in Graham, Tex., and received his B. S. in chemical engineering at Texas Technological College; M. S. in chemical engineering from the Univ. of Texas; and Ph. D. from the Univ. of Michigan. After working for the research dept. of Atlantic Refining, Bill Akers joined Rice Institute in 1947. He is now professor and chairman of the Dept. of Chemical Engineering.

SAM H. DAVIS, JR., received his B. S. degree in chemical engineering from Rice Institute in 1953. In 1956 he was awarded the Sc. D. in chemical engineering by MIT for his research on "Transients in Continuous Fractionators." Before joining the staff of Rice Institute in 1957, he was employed by General Electric.

instantaneous rate of work done by the system on the surroundings.

Eq. (2) is the usual starting point for the determination of the unsteady-state response of a closed system. It's important to recognize that the variables in Eq. (2) must account for all forms of energy and energy transfer. The total energy of the system E must include internal, kinetic and potential energy. The heat transfer rate q must include heat transferred by both conduction and radiation. The work w must include work of expansion of the system against external forces and work caused by movement of the system against external (frictional) forces.

If there is a mass exchange between the system and the surroundings, the energy balance becomes:

$$dE/dt = q - w + n_i (e_i + p_i V_i) - n_o (e_o + p_o V_o) \qquad (3)$$

where n_i and n_o are the mass flow rates into and out of the system; e_i and e_o are total energies per unit mass of the entrance and exit streams; p_i and p_o are the pressures of entering and leaving streams; and V_i and V_o are volumes per unit mass of entering and leaving streams.

If there are multiple entrance and exit streams, the energy input and output streams must be summed over all streams.

Consider the Case of Uniform Temperature

Eqs. (2) and (3) form the basis for solutions of problems in unsteady-state heat transfer. In this article we'll consider only those cases in which the temperature of the system is uniform and the total

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Numerical Solutions of Unsteady-State Heat Transfer Problems	S. H. Davis, Jr	Coming soon	—

energy of the system E can be expressed by a function of the single variable T. Later articles in this series will present solutions for cases where the temperature depends on position as well.

Consider an object that is being heated or cooled from some uniform initial temperature T_1. If the resistance to heat transfer at the surface is large compared to the internal resistance (high thermal conductivity), Eq. (2) can be used to describe the thermal process.

$$dE/dt = q - w$$
$$\text{then, } dE/dt = c_p \rho V\, dT/dt$$
$$q = hA\,(T_o - T);\ w = 0$$

where c_p, ρ, V and A are the thermal capacity, the density, the total volume and the surface area of the object; T is the uniform temperature at time t; and T_o is the environmental temperature. The heat-transfer coefficient at the surface is h.

Equating the terms in the above equation and rearranging, we obtain:

$$dT/dt = (hA/c_p \rho V)\,(T_o - T) \qquad (4)$$

If the heat-transfer coefficient h and the environmental temperature T_o are constant, Eq. (4) is integrated to give:

$$\ln\,(T_o - T) = (hAt/c_p \rho V) + I$$

and the constant of integration I can be evaluated at time $t = 0$, to give:

$$I = \ln\,(T_o - T)$$

Therefore, the solution may be written as follows:

$$(T_o - T)/(T_o - T_1) = e^{-b}$$
$$\text{where } b = (hA/c_p \rho V)\,t \qquad (5)$$

This solution indicates that under the described conditions of heating or cooling, the temperature of an object will vary exponentially with time. Moreover, the time interval required for a particular temperature change will vary directly as the thermal capacity, density and volume-to-surface ratio, V/A; and inversely with the surface heat-transfer coefficient h.

How Long Does Quenching Take?

Now we're ready to solve some actual problems in unsteady-state heat transfer.

Problem 1—A metal billet at 1,200 F. is dropped into a water quench tank at 212 F. If the billet temperature drops to 600 F. in 3 min., how long will it take to cool to 250 F.?

Solution—Eq. (5) solves this type of problem:

$$\ln\,[(600 - 212)/(1{,}200 - 212)] = -(hA/c_p \rho V) \qquad (3)$$
$$hA/c_p \rho V = 0.313$$

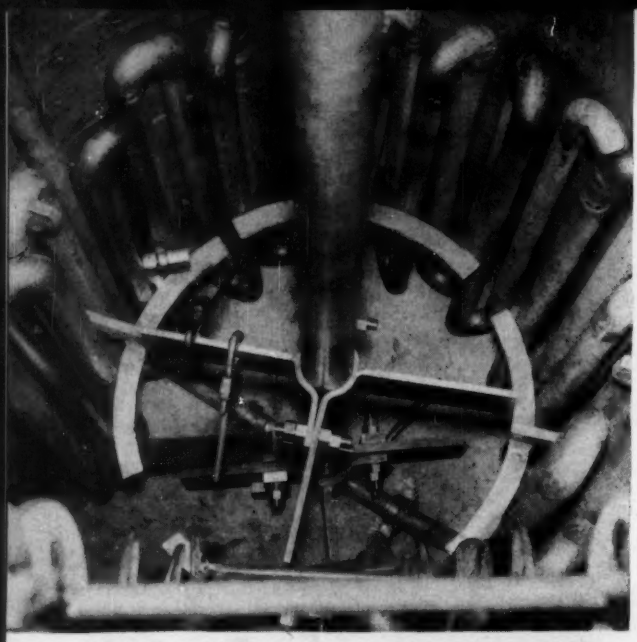
Then,

$$0.313\,t = \ln\,[(1{,}200 - 212)/(250 - 212)]$$
$$t = 10.4 \text{ min.}$$

Problem 2—If a billet of the same shape and same material as in Problem 1, but having all dimensions ten times as great, were quenched under the same conditions, how long would be required for the temperature to drop from 1,200 F. to 250 F.?

Solution—In Eq. (5), the only term that has been changed is the V/A ratio. This has been increased by a factor of 10. Therefore the time will be 104 min.

If it were desired to cool the larger billet in the same time, the heat-transfer coefficient would have



SIZING COOLING COILS in stirred tanks calls for a knowledge of unsteady-state heat transfer equations.

to be increased tenfold. This might be done by increased agitation in the quench tank.

The instantaneous heat transfer rate q can be calculated using Eq. (5):

$$q = hA\,(T_o - T)$$
$$(T_o - T) = (T_o - T_1)\,e^{-b}$$
where $b = hAt/c_p\rho V$
$$q = hA\,(T_o - T_1)\,e^{-b} \qquad (6)$$

The cumulative heat transferred Q can be obtained by integrating:

$$Q = \int_{t=0}^{t} q\,dt$$

Substituting values of q from Eq. (6) and integrating gives:

$$Q = c_p\,\rho V\,(T_o - T_1)\,(1 - e^{-b}) \qquad (7)$$
where $b = hAt/c_p\,\rho V$

Of course the exponential term b in Eqs. (5), (6) and (7) are identical. Solving each for the exponential and equating:

$$e^{-b} = \frac{T - T_o}{T_1 - T_o} = \frac{q}{hA\,(T_o - T_1)} = 1 - \frac{Q}{c_p\,\rho V\,(T_o - T_1)} \qquad (8)$$

thus showing the relation between the temperature T, the instantaneous rate q and the cumulative heat transferred Q.

Heat Transfer in Heat Exchangers

The heating or cooling of a fluid as it passes through a tube or heat exchanger is another special case of unsteady-state heat transfer. Here a fluid element is continually changing temperature as it flows.

Problem 3—A fluid enters a tube of radius r at temperature T and flows at constant velocity V_1 through the tube with length L. The tube-wall temperature is constant T_o and the heat-transfer coefficient can be taken as being constant, U_1. Compute the fluid temperature as a function of the distance x from the entrance.

Solution—If the velocity is appreciable, we may neglect the axial transfer of energy in the tube. Then the terms of Eq. (2) can be evaluated for an incremental element as:

$$dE/dt = \rho\,c_p\,\pi r^2\,dx\,dT/dt$$
$$q = U_1\,2\pi r\,(T_o - T)\,dx$$

Equating and rearranging,

$$dT/dt = 2U_1\,(T_o - T)/r\,\rho\,c_p$$

Integrating, we have:

$$T_o - T = Ie^{-b}$$
where $b = 2\,U_1\,t/r\,\rho\,c_p$

Since $T = T_1$ at $t = 0$; and $t = x/V_1$, we have:

$$\frac{T_o - T}{T_o - T} = \exp\frac{-2\,U_1\,Lx}{r\,\rho\,c_p\,V_1\,L} = \exp\frac{-\alpha_1\,x}{L} \qquad (9)$$
where $\alpha_1 = 2\,U_1\,L/r\,\rho\,c_p\,V_1$

Eq. (9) gives the temperature of the fluid as a function of the distance x from the entrance. At $x = L$ we have the exit fluid temperature.

Problem 3 gives rise to another very interesting problem in unsteady-state heat transfer. Suppose the velocity of the fluid is suddenly increased. What will be the temperature of the fluid within the tube at any time after the change in velocity?

Problem 4—The velocity of the fluid in Problem 3 is suddenly increased to V_2 with corresponding heat-transfer coefficient U_2. Calculate the temperature of the fluid at any point in time t after the velocity change.

Solution—If the time t is equal to or greater than L/V_2 the point temperature can be expressed by Eq. (9):

$$\frac{T_o - T}{T_o - T_1} = \exp -\alpha_2\,x/L$$
where $\alpha_2 = 2\,U_2\,L/r\,\rho\,c_p\,V_2$

because a steady-state temperature distribution will have been achieved. But consider the fluid temperature between $t = 0$, when the velocity was increased from V_1 to V_2, and $t = L/V_2$, when steady-state conditions would have been achieved. Then,

$$\frac{T_o - T}{T_o - T_1} = \exp\left(-\frac{\alpha_1\,x}{L} + \frac{(\alpha_1 - \alpha_2)\,V_2\,t}{L}\right) \qquad (10)$$
for $x = V_2\,t \rightarrow x = L$

Also,

For $x < V_2\,t > 0$
$$\frac{T_o - T}{T_o - T_1} = \exp -\alpha_2\,x/L$$
for values of $V_2\,t/L$ less than 1

Therefore Eq. (10) gives the temperature as a function of the position x and the time t of the fluid in the tube. Eq. (10) also allows us to calculate the heat transfer rate q for the tube at any time in the interval of $t = 0$ to $t = L/V_2$

$$q\,(t) = 2\pi r\,L\,U_2 \int_{x/L=0}^{x/L=1} (T_o - T)\,d\left(\frac{x}{L}\right)$$

Substituting Eq. (10) for $(T_o - T)$ and integrating gives a difficult looking exponential equation that permits the calculation of the total heat rate q at any time t.

Examining each of the preceding examples shows

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that the instantaneous temperature difference ($T_o - T$) is directly proportional to the initial temperature difference ($T_o - T_1$) and varies exponentially with time. Thus, in each case, the log of the instantaneous temperature difference will vary directly with time.

Similarly the instantaneous heat transfer rate q will vary directly with the initial temperature difference ($T_o - T_1$) and be an exponential function of time.

When You Have Mass Transfer Also

In cases in which there is mass exchange between the system and the surroundings, we can make a similar analysis using Eq. (3). Here are some worked-out examples.

Problem 5—An electric hot water heater contains 100 gal. of water at 160 F. Water is suddenly removed at the rate of 10 gpm. and cold water at 80 F. is admitted at the same rate. When water is withdrawn, the electric heater supplies heat at a net rate of 50,000 Btu./hr. Calculate the temperature of the water as a function of time, assuming that the temperature in the tank is uniform.

Solution—Using Eq. (3) as a basis,

$$dE/dt = V_o \rho c_p \, dT/dt$$
$$n_i = 0; n_o (e_o + p_o V_o) = V_f \rho c_p (T - T_o)$$

where V_o is the volume of the system; V_f is the volumetric flow rate of the water in and out; T_o is the temperature of the water in; and T is the temperature of the heated water out.

If we equate,

$$V_o \rho c_p \, dT/dt = q - V_f \rho c_p (T - T_o)$$
$$\frac{dT}{dt} = \frac{q}{V_o \rho c_p} - \frac{V_f}{V_o} (T - T_o)$$

Integrating,

$$1 - \frac{\rho c_p V_f}{q} (T - T_o) = Ie^{-b}$$

where $b = V_f t/V_o$

at $t = 0$ and $T = T_1$, solving for the constant of integration, substituting and rearranging, we get:

$$\left[1 - \beta \frac{T - T_o}{T_1 - T_o}\right] / (1 - \beta) = e^{-b}$$

where b is as given above; and $\beta = \rho c_p V_f (T_1 - T_o)/q$ Rearranging, we arrive at:

$$\frac{T - T_o}{T_1 - T_o} = (1/\beta) - \frac{(1 - \beta)}{\beta} e^{-b} \qquad (12)$$

This equation gives the temperature as a function of the time. The instantaneous temperature difference ($T - T_o$) is not directly proportional to the initial difference ($T_1 - T_o$) because β has this term included. Moreover, the temperature difference is not directly proportional to the exponential of time. However, the same general form can be preserved if the term β is transferred to the left side of Eq. (12) and included with the temperature difference.

Applying numerical values to Eq. (12) for Problem 5, we obtain:

$$\beta = (8.33)(10)(60)(160 - 80)/50{,}000 = 8$$
$$V_f/V_o = 10/100 = 0.1$$
$$T - 80 = 80\left[\frac{1 + 7e^{-0.1t}}{8}\right]$$
$$T = 90 + 70e^{-0.1t}$$

Heat Transfer in Stirred Tanks

Another example of unsteady-state heat transfer with mass flow is the heating of a fluid in a well-stirred tank.

Problem—A vertical cylindrical tank capable of holding 1,000 gal. of liquid is steam jacketed so that heat is transferred through the side walls. Water is admitted at the rate of 10 gpm. and a temperature of 80 F. If the wall temperature is maintained at 220 F. and the (UA) product when the tank is filled with water is 10,000 Btu./(hr.) (°F.), calculate the temperature of the water as the tank is filled, assuming no water in the tank initially.

Solution—Using Eq. (3) as a basis,

$$\frac{dE}{dt} = \rho c_p \frac{dV (T - T_1)}{dt}$$
$$q = UA (T_o - T)$$
$$n_i (e_i + p_i V_i) = 0; n_o = 0$$

where V is the volume of water in the tank; V_f is the volumetric flow rate into the tank; T_o is the wall temperature; T_1 the entering water temperature; and T is the instantaneous water temperature at time t.

Equating,

$$\rho c_p \frac{d}{dt} V (T - T_1) = UA (T_o - T)$$

now,

$$V = V_f t; UA = U_o A_o (V_f t/V_o)$$

where $U_o A_o$ is the (UA) product when the tank is full; and V_o is the volume of the filled tank. Note that $V_f t/V_o$ must be less than 1.

Substituting these values, we get:

$$\rho c_p (T - T_1) + \rho c_p V_f t \frac{d (T - T_1)}{dt} = (U_o A_o V_f t/V_o) (T_o - T)$$

If we let

$$\tau = t V_f/V_o; \theta = (T - T_1)/(T_o - T_1); \beta = U_o A_o/\rho c_p V_f$$

the differential equation reduces to the dimensionless form:

$$\theta + \tau \, d\theta/d\tau = \beta\tau (1 - \theta)$$

whose solution is

$$\theta = 1 - \frac{1 - e^{-\beta\tau}}{\beta\tau}$$

with boundary conditions $\theta = 0$ at $\tau = 0$.

Substituting numerical values we find that:

$$\beta = 2; V_f/V_o = 0.01$$
$$T_o = 212 \text{ F.}; T_1 = 80 \text{ F.}$$

These examples illustrate the basic techniques for handling unsteady-state heat transfer in systems in which the temperature is a function of time and not position. The basis for the solutions is given by Eqs. (2) and (3).

In each case we see that the temperature is an exponential function of time. Although the premise was that the temperature was uniform throughout the system at any time, the equations may be used if the energy of the system can be expressed as a function of an averaged temperature.

In our next article, consideration will be given to those cases where the temperature is position dependent. In these cases the solutions involve the solution of partial differential equations.

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For complete engineering data, write for Bulletin TR-10-A.

EAI ELECTRONIC ASSOCIATES, INC.
Long Branch, New Jersey

CE COST FILE

No. 29: Analysis of Ethylene Plant Costs

J. E. Haselbarth and J. M. Berk, Pritchard & Abbott, Houston, Tex.

Three Estimates Show Importance of Definition

Total chemical plant investment is the sum of direct and indirect costs—the total amount of capital necessary for the completed project—but it does not include working capital for plant operation. Direct costs include purchase, transportation and installation of all physical components of the complete plant. Indirect costs include engineering, overhead, pre-operation charges, startup and contingencies.

Direct and indirect costs can be developed for preliminary estimates by factoring, a technique outlined by H. J. Lang, *Chem. Eng.*, June 1948, pp. 112-113. If principal equipment items can be identified and their delivered cost calculated, an estimate of total cost can be determined. If over-all plant cost is known, costs of various components can be found. Finally, if battery limits investment of a producing unit is known, cost of component parts of that unit can be determined.

In order to estimate costs of plant construction, it's necessary to have clear definitions of the project boundaries. We may conveniently divide construction projects into three classifications: grass roots plant construction, new producing unit located within previously developed plant site, and enlargement of an existing unit.

To show how project classification affects allocation of costs in the preliminary estimate, we have determined investment necessary to build a plant in the Gulf Coast area (outdoor construction) to manufacture 120 million lb./yr. of ethylene from refinery gases. These data can be used in preliminary estimates; for other capacities, use a power factor of 0.7 (see *Chem. Eng.*, Mar. 7, '60, p. 116). Data are as of Oct. 1, 1959. Land values are not included.

Grass Roots Petrochemical Plant

	$	%
1. **Process equipment bare costs** Includes furnaces, towers, compressors, vessels, tanks, pumps, heat exchangers and other principal items.	2,550,000	24.0
2. **Process equipment installation**	1,650,000	15.5
3. **Battery limits piping,** installed	1,475,000	13.9
4. **Instrumentation,** installed	380,000	3.6
5. **Battery limits electrical** installations	300,000	2.8
6. **Buildings and enclosures,** battery limits	35,000	0.3
7. **General plant services** Drainage, landscaping, roads, walks, etc.	350,000	3.3
8. **General buildings** Includes administrative buildings, shops, change rooms, garages, stores, buildings, etc.	450,000	4.2
9. **Utilities** Includes steam, gas, electricity, water, etc.	1,100,000	10.3
10. **Receiving, shipping and storage** Includes tankage, railroad trackage, warehouses, etc.	600,000	5.6
11. **Indirect costs** For a plant to produce ethylene alone; where complexity is not of a high degree.	1,750,000	16.4
Total capital investment	**$10,640,000**	**100.0**

New Producing Unit Within Previously Developed Plant Site

For this installation, it is assumed that: no general service improvements are needed; present utilities will be expanded; minor additions to general buildings are needed; small additions to receiving, shipping and storage facilities will be needed.

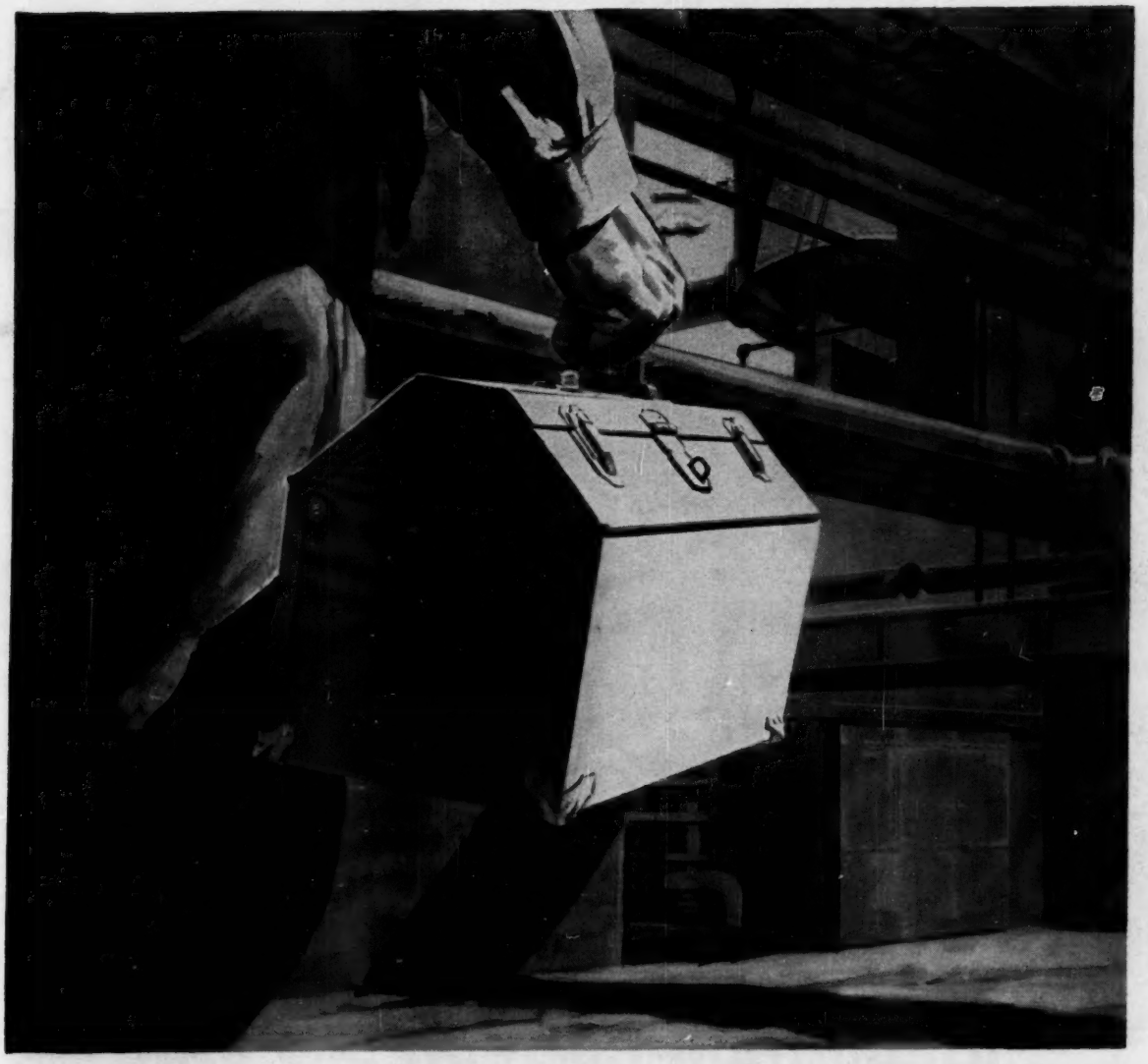
	$	%
1. **Process equipment bare costs**	2,550,000	30.8
3. **Process equipment installation**	1,650,000	19.9
3. **Battery limits piping,** installed	1,475,000	17.8
4. **Instrumentation,** installed	380,000	4.6
5. **Battery limits electrical** installations	300,000	3.6
6. **Buildings and enclosures,** battery limits	35,000	0.4
7. **General services**		0.0
8. **General buildings**	40,000	0.5
9. **Utilities**	500,000	6.0
10. **Receiving, shipping and storage facilities**	250,000	3.0
11. **Indirect costs**	1,100,000	13.3
Total capital investment	**$8,280,000**	**100.0**

Enlargement of an Existing Unit

For this type of installation, cost savings described in Case 2 will apply; it can also be assumed that existing structural work can be expanded to accomodate most new facilities. Too, certain revisions to existing process equipment can be made which will give further savings.

	$	%
1. **Process equipment bare costs**	1,850,000	26.2
2. **Process equipment installation**	1,500,000	21.2
3. **Battery limits piping,** installed	1,300,000	18.4
4. **Instrumentation,** installed	350,000	5.0
5. **Battery limits electrical** installations	300,000	4.2
6. **Buildings and enclosures,** battery limits	15,000	0.2
7. **General services**		0.0
8. **General buildings**		0.0
9. **Utilities**	500,000	7.1
10. **Receiving, shipping and storage facilities**	250,000	3.5
11. **Indirect costs**	1,000,000	14.2
Total capital investment	**$7,065,000**	**100.0**

ALLIS-CHALMERS



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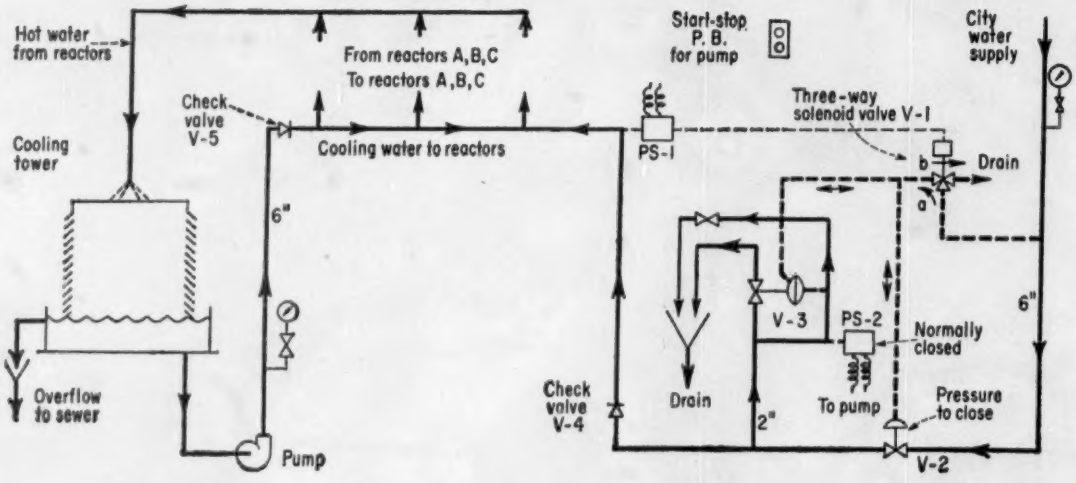

Automatic Switch for Cooling Water

Using city water as an automatically controlled alternate for cooling-tower water needs care in preventing possible city water contamination.

★ **Winner of the February Contest by**
R. L. Smith
Engineering Supervisor, Monsanto Chemical Co., Plastics Div., Springfield, Mass.

When exothermic reactions are being run, it is often necessary to provide automatic protection against failure of the normally used recirculated and treated cooling-tower water supply. Such protection can be obtained by providing a cross tie with the city or potable water supply—but it is very important that this cross tie be made in such a way as to prevent positively any possibility of contaminating the city water supply.

The diagram above shows a schematic of an economical automated system which will immediately supply city water should pressure be lost in the normally used cooling water system. It provides complete isolation of the city water supply and will operate on loss of cooling water pressure and/or loss of electric power. The automatic changeover from cooling tower water to city water restores pressure in 3 to 5 sec. It takes 20 to 30 sec. for the operator to reset to cooling-tower water.

Cooling water at 50 psig. is normally supplied to the exothermic reactors *A*, *B* and *C* by the pump shown, using a 6-in. line. Hot water returning from the reactors flows to the cooling tower through another 6-in. line. As long as the pressure is maintained, pressure switch PS-1 energizes the latched solenoid three-way valve V-1 in position *a*. In position *a* V-1 maintains city water pressure on the diaphragm of V-2, holding it closed. It also maintains pressure on the under side of the diaphragm of V-3, thereby keeping V-3 open. Thus V-2 and the check valve V-4 isolate the cooling-tower water to the left of V-4 from the city water. Between V-2 and V-4 the 2-in. line connected to the open sewer, either through or around V-3, maintains a zero pressure. With zero pressure, the normally closed contacts of PS-2 allow the pump to run. (*Cont.*)

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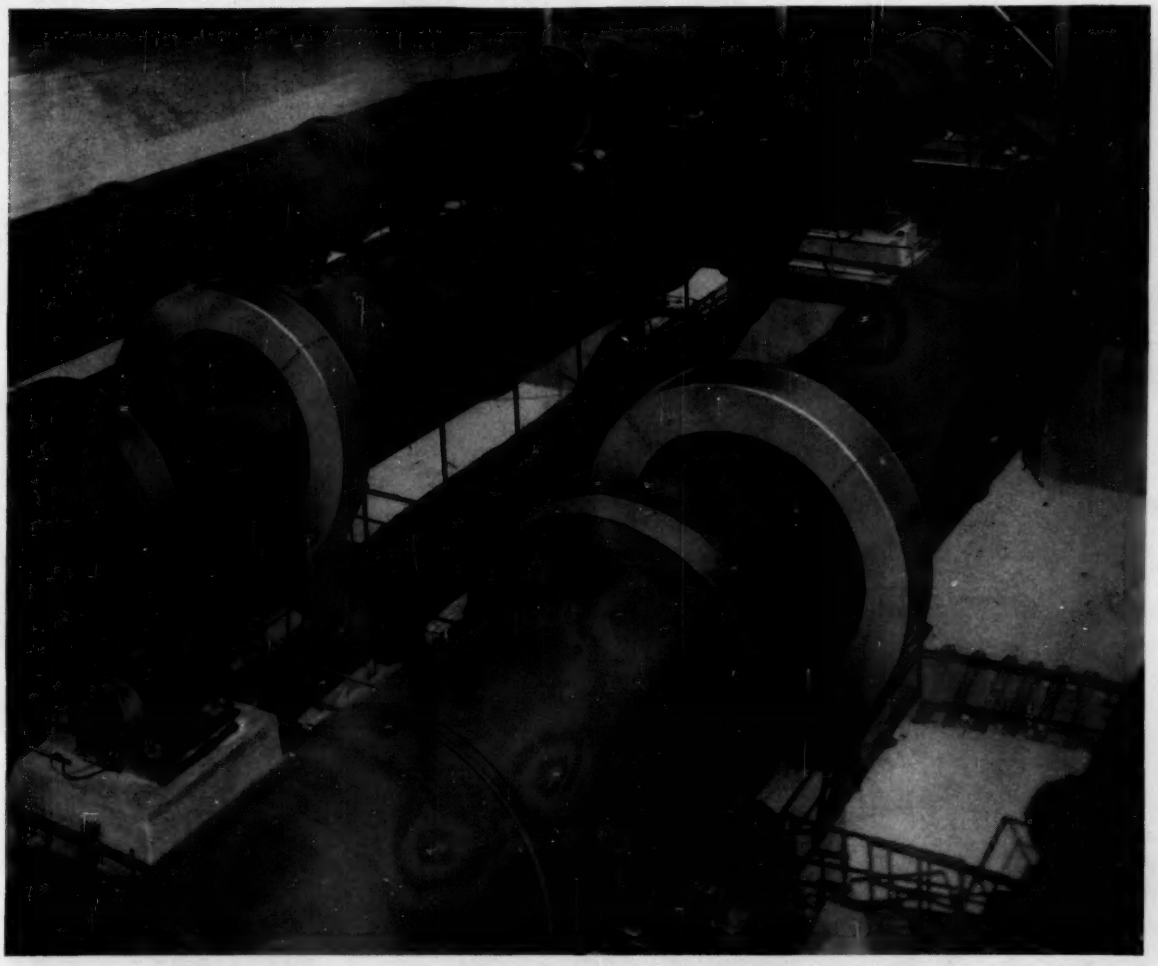

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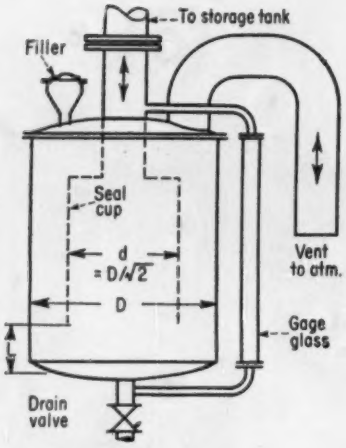
With loss of pressure in the cooling water supply line, PS-1 opens and de-energizes the solenoid on V-1, immediately shifting this three-way valve to position *b*. In this position the diaphragm of V-2 is vented and V-2 opens to admit the city water. City water immediately flows at a high rate through the 2-in. line and V-3 to the sewer, which in turn increases the pressure in the 2-in. line, closing V-3 and opening the contacts on PS-2. This stops the pump (if operating) and prevents the pump from starting until restarted at the push-button.

Check valve V-5 now prevents city water from flowing to the pump. The return of hot city water from the reactors flows back to the cooling tower and overflows to the sewer. Under these circumstances of automatic shiftover the chemical treatment is lost—but this is ordinarily not worth the added expense of an automatic diversion valve to the sewer.

After the emergency, to return the system to cooling-tower water, the operator manually holds solenoid valve V-1 in the *a* position and holds down the pump start button until pressure is vented from PS-2, allowing the pump to run normally and provide pressure at PS-1 which will energize the V-1 solenoid.



Liquid Seal Will Prevent Overpressure

Leonard Steber
Chemical Engineer, Fords, N. J.

Using desiccant-type dry vents on liquid storage tanks can lead to trouble if the granular beds become plugged with caked drying agent. To provide pressure and vacuum relieving devices to protect against collapse nullifies the purpose of the desiccant, of course, by admitting moist air into the tank.

Using liquid moisture absorbents as in the accompanying sketch will overcome the difficulties mentioned. The vent tank shown has a vapor-tight cover, inverted seal cup, atmospheric vent, liquid fill connection, gage glass and bottom drain for removing the spent drying agent.

The volume of vent tank required can be estimated on the basis of the range of absorbent concentration through which air drying is effective; the retention period allowed for one absorbent liquid fill; the number of emptying cycles to be expected; and the amount of moist air intake expected due to tank "breathing" through daily temperature variations. Assume saturated air for the warmest weather to be expected to provide ample vent tank volume for high humidity periods.

The diameter of the cup should be such as to give a cup cross-sectional area equal to that of the annulus. Then, $d = D/\sqrt{2}$. The clearance L should allow a flow area between the cup and the vent tank bottom at least equal to the annulus area.

In use the vent tank is filled about half full with a drying agent such as concentrated sulfuric acid. When the storage tank is being emptied, the liquid level in the annulus falls to the bottom of the cup and atmospheric air enters, bubbling through the drying liquid and flowing to the storage tank. When filling the storage tank, the reverse actions take place, with air from the tank bubbling through the vent tank.

Construction materials must, of course, be suitable for all possible concentrations of the drying agent. For example, lead, 18-8 stainless, acid-resin-coated and glassed steel components will be suitable for concentrated sulfuric. Carbon steel would be suitable only if the concentration were maintained above about 85% acid.

Correction—We are indebted to A. M. Woodall of Rust Engineering Co., Birmingham, Ala., for calling attention to a typographical error in Eq. (3) on p. 144 of our Feb. 8 issue. π was dropped from the term $4V/7.48\ \pi\ D^3$. For hemispherical heads Mr. Woodall points out the last term can be $2D/3$.

Next Issue: Watch for Winner of March Contest

★ How Readers Can Win

$50 Prize for a Good Idea—Until further notice the Editors of *Chemical Engineering* will award $50 each four weeks to the author of the best short article received during that period and accepted for Plant or Process Design Notebooks. Each period's winner will be announced in the second following issue and published in the third or fourth following issue.

$100 Annual Prize—At the end of each year the period winners will be rejudged and the year's best awarded an additional $100 prize.

How to Enter Contest—Any reader (except a McGraw-Hill employee) may submit as many contest entries as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Acceptable nonwinning articles will be published at space rates ($10 minimum).

Articles should interest chemical engineers in development, design or production. They may deal with useful methods, data, calculations. Address Plant & Process Design Notebooks, *Chemical Engineering*, 330 W. 42 St., New York 36, N. Y.

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comes in oceans, rivers, lakes, wells,
drops, buckets, pitchers and glasses.
it quenches thirsts, cooks food, puts
out fires, makes coffee and
brushes teeth. it spins mills,
runs electro-plants, cools motors
and power factories.
it spawns fish, sprinkles lawns,
floats boats, washes children
and grows flowers.

it sustains and nurtures.
it bends if you give it purpose.
it reshapes itself if you give it reason.
it is needed, wanted, feared,
praised and prayed for.

it is at the heart of all life.
it is in the arteries of all industry.
it is as close to us as skin
but as taken for granted as sky.

the end of water seems unbelievable.
if it is not on the horizon, it is just over it.
if it is not within sight,
it is just 'round the bend.
if it is not in the glass,
it is just in the spigot.

. . . this is the grand mirage . . .
the self-delusion that prevails
though the wells run low
and the streams go dry
and the water slips away.

we know water.
we know its ways.
we've learned its habits.
we've pulled it out of swamplands,
pushed it over mountains,
pumped it into deserts,
tunneled it through granite,
and rescued it from pollution.

above all else,
we know the need for it.
that is why,
for 130 years,
we've developed new uses for,
powered new factories with,
diverted the courses of
and jealously stood guard over
water.

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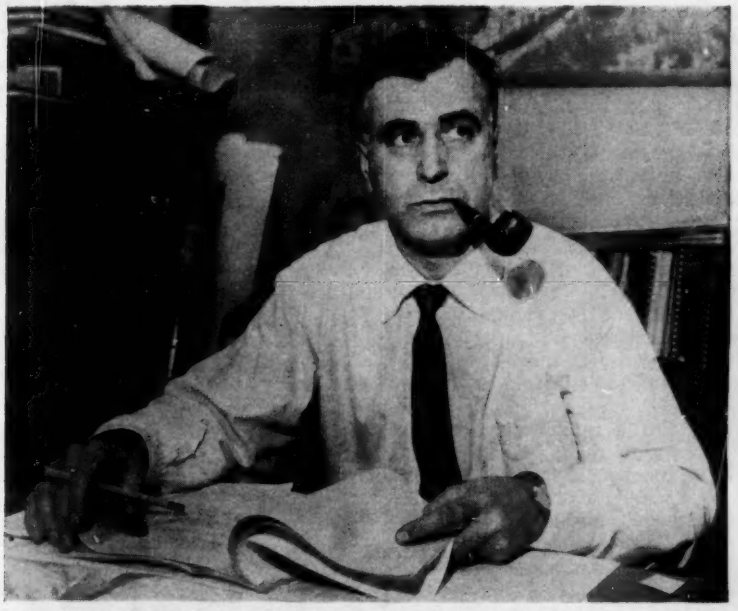


EUGENE ANDREWS is a chemical engineer in an unusual job.

Meet a . . .

Chamber-of-Commerce Chemical Engineer

Education and experience in chemical engineering may often be quite valuable to an employer on the fringe of the process industries. Here's a rather interesting example.

Paul Hauser, McGraw-Hill World News, Portland, Ore.: and Emil J. Mikity, Western Editor, San Francisco, Calif.*

Eugene Andrews of Portland, Ore., is a rarity among chemical engineers. He's a chamber-of-commerce chemical engineer.

Actually, the lettering on his office door in the ivy-covered Portland Chamber of Commerce Building is Manager, Dept. of Industries. Consideration of the chemical process industries (CPI) is only a part of his duties, but the fact that he is a graduate chemical engineer ranked high in his selection for the job.

Portland has a small but steadily growing chemical industry and its leaders are convinced that advantages such as Central Pacific location, good transportation, low-cost electric power and abundant pure water are sure to attract many other chemical operations to the area.

Andrews' predecessor, the late Chester K. Sterrett, was also a chemical engineer and the Portland Chamber of Commerce wanted another one to succeed him.

▶ **Not Quite, But Almost**—Andrews recently had a considerable disappointment when Dow

* Emil Mikity is now Assistant Managing Editor of *Chemical Week*, a McGraw-Hill publication, in New York.

Chemical Co. chose to locate its new West Coast phenol plant at Kalama, Wash., instead of in Portland. His disappointment was assuaged, however, by the fact that Kalama, a small Columbia River port, is only 40 miles from Portland and is actually in the industrial orbit of Portland's metropolitan area.

The Dow plant at Kalama is expected to provide a spurt to CPI development in the area. And the selection by Dow of a Columbia River port is still a victory for Portland over its bitter rivals, Seattle and Tacoma, on Puget Sound.

▶ **Ear to the Ground**—Portland's campaign to attract Dow, though not completely successful, gives some idea of what a chamber-of-commerce chemical engineer does on the job.

As soon as the rumble came that Dow was in the field (an alert ear to the ground is a necessary attribute for the job) Andrews started machinery in motion. Meetings were arranged with Dow representatives. Andrews had to assess the company's needs and prepare a presentation to show how Portland was ready and willing to satisfy these needs.

"In this kind of a job it's a great advantage to be able to talk in technical language to people about their products and processes," says Andrews. "As a chemical engineer, you know without a short course what the big problem is. Maybe it's raw materials; maybe it's water; maybe it's markets.

"You know what inducements you have to bring them into your area. It's pretty hard to just go in and say, 'Look, we've got a nice place here. We'd sure like to have you.'"

It takes a lot more than knowledge of how things are done in the chemical industry, however. Andrews has to have fingertip knowledge of state and local taxes and their effect on industry. He has to be familiar with rail, water and truck routes and rate data. He has to know about schools and rents and living costs, and even cultural opportunities.

Another big part of the job is the ability to call on executives of other industries, local government officials and agencies for assistance in pinning down a plant-location sale. In the Dow case Andrews worked closely with the Oregon Development Commission, whose board of leading Oregon industrialists helped keep the door open for the Columbia River area after it seemed to be swinging shut.

The things Andrews could tell Dow about advantages for a chemical plant on the fringe of Portland proper turned out to apply as well to Kalama. Dow's inclination toward small towns and an apparent local tax advantage is credited in Portland with swinging the balance.

▶ **Go West Young Man**—There was some additional satisfaction for Andrews because Kalama is part of the area covered by the Longview-Cowlitz Industrial Bureau, where as manager he laid the groundwork for snaring chemical industries prior to Nov. 1958.

In 1956, Andrews came to Longview and the West Coast from Minnesota, where he had been Director of Business and Industrial Services of the Minnesota Dept. of Business Development. Minnesota is his native state. He was born in Minneapolis.

A feeling that something ought to be done to develop chemical engineering jobs in Minnesota pushed him into the industrial development field from a teaching post at the Univ. of Minnesota, the school where he graduated as a chemical engineer in 1944. Andrews returned to the university when he was discharged from the Navy in 1946 (he was engineering officer on a submarine) to teach mathematics and mechanics and to do graduate work in the field of industrial engineering.

He also served as editor of the university's engineering magazine, *Techno Log*.

As a teacher in the school of chemical engineering, Andrews was concerned that there were fewer opportunities in Minnesota for chemical engineering graduates than there were graduates who wished to remain in the state. In 1950, when the chance for a job with the Minnesota Dept. of Business Development came up, Andrews thought this might be an opportunity to do something about it.

But instead of working primarily with chemical industry prospects he found himself concerned mostly with the booming electronics industry.

The Pacific Northwest's potential for chemical industries, plus a devotion to outdoor hobbies from camping through skiing, led to his decision to move west in 1956. He and his wife moved out to the West Coast. Their three children, two boys and a girl, are all West Coast natives. And they're likely to remain Pacific Northwesterners.

Like many other transplanted Midwesterners, Andrews has fallen in love with mountains.

"It's real nice," he says, "not to have to live in the snow and still have it handy."

OF 10,000

. . . *You're the Smartest*

Aptitude tests are valuable in showing a person's ability to prepare for an occupation, but they cannot predict his success or satisfaction on the job.

This is the major conclusion of a study on 10,000 World War II airmen and their postwar occupations, directed by Profs. Thorndike and Hagen of Teachers College, Columbia Univ. Results are detailed in the new book "10,000 Careers," John Wiley, New York (1959).

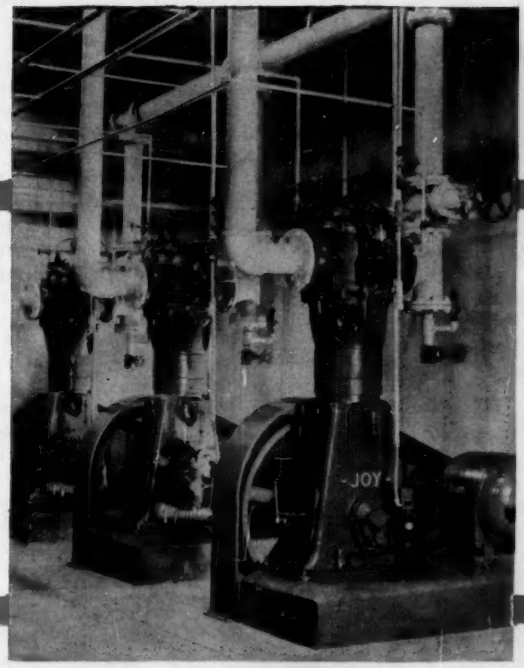
Although most of the text is unintelligible to anyone not trained in psychological testing and its weird jargon, one undisputed point is clearly discernible to any reader. Of the 124 occupations tested, highest general intellectual level was exhibited by chemical engineers—believe it or not.

In comparisons with other branches of engineering, chemical engineers scored best in general intellectual and numerical tests; fell behind in perceptual-spatial, mechanical and psychomotor. Chemicals tended to have well-educated fathers and native-born mothers.

You & Your Job continues on page 204.

FOR OIL-FREE AIR WITHOUT EXCESSIVE MAINTENANCE

JOY WGO-9 COMPRESSORS



A continuous supply of oil-free air is guaranteed by this multiple installation at a midwestern container factory. Vertical design means reduced maintenance . . . the piston ring need never be rotated.

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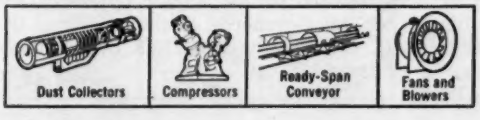

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Congratulations to Frank E. Block

For the third successive year a Bureau of Mines staff member has captured one of the highly coveted Arthur S. Flemming Awards, voted to outstanding young men in Federal jobs.

Frank E. Block, 37-yr.-old supervisory chemical engineer at the Bureau's Albany, Ore., metallurgy research center is the recipient. Block was nominated by the Dept. of the Interior in recognition of his achievement in metallurgical research. Among the noteworthy developments credited to him are:

- Creation of a process now used by industry to separate columbium and tantalum—metallurgical "Siamese twins" that long defied conventional separation methods.
- Invention of a greatly improved technique that has made possible production of high-purity yttrium, dysprosium and other rare-earth metals needed in developing new structural materials for nuclear reactors, missiles and space vehicles.
- Direction of research that led to a new metallurgical process enabling industry to produce high-purity vanadium for less than half its former price.
- Development of methods for recovering zirconium and tin from waste materials.

Block joined the Bureau of Mines in 1948 after graduation from Oregon State as a chemical engineer. His record of research in government won him the Department of the Interior's meritorious Service Award in 1958.

The Flemming awards are sponsored by the Junior Chamber of Commerce, Washington, D. C.; and the American Security and Trust Co.

ENGINEERS

. . . *Go on Strike*

Over 1,100 technologists—including senior engineers and scientists—refused to work for one day last month at the Atomic Energy Research Establishment in Britain.

The token strike, which involved the great majority of the professional research staff, was in protest over pay, status and administrative grievances. According to a statement issued by the Secretary of the Institution of Professional Civil Servants (IPCS), the strike was an outstanding success. He said:

"This spontaneous and extraordinary demonstration should be a warning to the [Atomic Energy] Authority that there is a limit to which even highly placed [engineers and] scientists can be pushed."

Legally, civil servants in Britain can't strike. Therefore, the artifice of a mass application for one day of leave was used. If this had been denied, the personnel were planning to report sick instead.

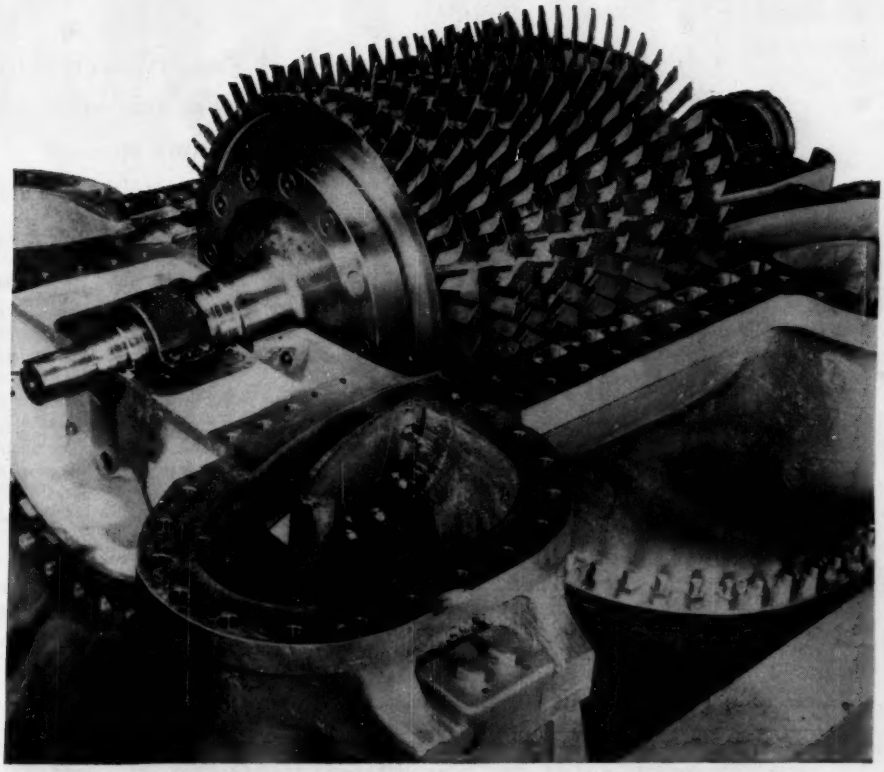
Status—as well as pay claims—was behind the mass demonstration. There is a widespread feeling at Harwell, and in British industry as well, that professional employees have inadequate status compared administrative ranks; and that their status is not commensurate with their responsibilities.

Senior administrators at Harwell have increased 66% in number since 1958, while the number of engineers and scientists has increased only 22%. In effect, the technical men complain, there are fewer people available to do more work, and more supervisors to strangle the effort.

Another sore point: except for cost-of-living increases, only administrative staffers have been receiving pay increases since 1958.

Micheal Ridout, secretary of the IPCS branch at Harwell summed up the position of the strikers this way: "We are fed up with people who pay lip service to the value of the scientist to the community, and then proceed to dominate him by administrators."

HIGHER STAGE PERFORMANCE OF JOY DYNAMIC COMPRESSORS MEANS LOW COST AIR



The higher stage performance of Joy Centrifugal and Axial Compressors can save you money by reducing the cost of your plant and process air. Because of higher efficiency, Joy compressors can provide the air you need with fewer stages. This means fewer parts, fewer inter-stage seals, shorter and more rigid rotors, lower bearing loads, and many other design features which reduce both the installed cost and the maintenance cost of the machines.

Joy dynamic compressors can be supplied in sizes from 15 to 15,000 hp, and can be designed for any class of service from furnishing plant air to compressing hot process gases. Whatever the air or gas compressing problem, you can be certain that a Joy dynamic compressor will be the most efficient solution. For complete information, write for Bulletin 348-11.

AIR MOVING EQUIPMENT FOR ALL INDUSTRY

JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

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Improve Small Plant Materials Control

- Conserve working capital
- Eliminate excessive inventories
- Reduce spoilage
- Accurately forecast requirements

Alfred J. Bohl, Wolf Management Engineering Co., Chicago, Ill.

Many a chemical plant has found itself choked off from further growth just at the moment when sales and orders indicated that it was about to break through and embark on a major expansion.

The reason: shortage of working capital.

In many cases, however, this is equivalent to saying the patient died because his heart stopped beating. Why the shortage of working capital in the first place? Often, it was frittered away through inadequate control of money spent on raw materials—poor materials control.

▶ **What Is Materials Control?**—Proper materials control requires a balance between raw materials purchases, production, and sales of finished products to avoid excessive inventories or shortages. It involves (1) ordering the right raw materials and chemical components, (2) ordering economically, (3) ordering in reasonable quantities to avoid inventory and spoilage problems, (4) receipt, inspection and storage of materials, (5) accounting for all materials, (6) measuring material usage against established standards and (7) following up to determine reasons for excessive material usage.

You can see that a materials control program affects many departments in a chemical plant and thus needs top level support and direction. Such a program also requires integrated planning and organization.

Since one of the most important parts of a materials control program is to see that there is adequate planning of what is to be produced—before materials are purchased—over-all control of the program should be the responsibility of the production manager. He is usually best suited for the job because it involves coordinating the activities of a number of departments with which he is familiar.

In many smaller chemical plants, a production control department, as such, may not exist. Nevertheless, the function of production control should be carried on by someone in authority.

▶ **Sales Forecasts Important**—A company should also develop sales forecasts to help prevent ruinous overstocking on the one hand or equally serious shortages on the other. These forecasts then become the bases for material purchases.

The time period for a sales forecast might be a month, a quarter or a year depending on the specific line a plant manufactures and the stability of the market.

By way of illustration, let us assume a plan to forecast on a quarterly basis. For each product we need a sheet on which we can combine known figures for past performances with estimated figures for future operations. Essentially, we must know (1) actual sales for the corresponding period in other years, (2) actual orders at the beginning of the period, (3) production authorized at the beginning of the period, (4) finished stock on hand at the beginning of the period, (5) shipments during the period and (6) estimated sales for the period coming up.

The illustration shows a simple form that we have found useful in keeping organized records.

By organizing the information along these lines, a chemical plant can often improve planning and scheduling remarkably. Similarly, when scheduling is well in hand, you can judge quite accurately concerning what kind of material will be needed, how much and when it will be needed. Also, by establishing suitable lead times—based on how fast material is used, how much can be stored and how long it takes to get it—low stock positions can be highlighted in advance.

It is wise to group materials according to their nature; for example, raw materials, supplies, work-in-process, packaging, etc. By doing this, you can obtain a more precise answer to the question of what material is necessary for production.

After production control, the

ENJAY DELIVERS 1,000,000th LONG TON OF BUTYL!

PRODUCTION FACILITIES INCREASED TO MEET CONSTANTLY GROWING DEMAND

There have been many elastomers developed since the first commercial ton of Butyl was used in 1943, but no other rubber, synthetic or natural, offers so many outstanding properties for so many applications.

Plant expansion plans announced recently will increase butyl production capacity some 50 percent by 1961 and, at today's rate of consumption, the two million-ton mark will be reached within the next six or seven years. Two new additions to the butyl product line, Chlorobutyl and Butyl Latex, will soon be available in commercial quantities.

VERSATILE ENJAY BUTYL'S OUTSTANDING PROPERTIES MAKE IT SUPERIOR TO OTHER RUBBERS FOR MANY APPLICATIONS. SOME ADVANTAGES:

- **RESISTS TEAR AND ABRASION** ... used in the new and revolutionary all-butyl tire.
- **STANDS UP AT HIGH TEMPERATURE** ... used in steam hose and tire curing bladders
- **HAS EXCELLENT ELECTRICAL PROPERTIES** ... used in high voltage cable insulation
- **IS IMPERMEABLE TO GASES** ... used in virtually all rubber air-holding applications
- **HAS WIDE RANGE OF DYNAMIC PROPERTIES** ... used in over 100 applications on the modern automobile
- **DISPLAYS OUTSTANDING CHEMICAL RESISTANCE** ... used for the storage and shipment of many chemical and commodity products
- **WITHSTANDS EXPOSURE TO SUN AND WEATHER** ... used in irrigation pipe and roof coatings.

Want to find out fast, how versatile Butyl can improve your product? Call or write the nearest Enjay office.

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ENJAY® BUTYL

Simple Form Helps Organize Material Control Program

	FIRST QUARTER Jan. - March	SECOND QUARTER April - June	THIRD QUARTER July - Sept.	FOURTH QUARTER Oct. - Dec.
UNIT SALES				
1958	121,330	132600	145685	146,310
1959	147,960	152,300	151,210	110,040
Est. 1960	155,000	157,000	150,000	150,000
ACTUAL ORDERS				
1958	120,600	129,800	143,250	145,610
1959	148,670	152,500	149,210	0
Est. 1960	150,000	156,000	142,000	140,000
PRODUCTION AUTHORIZED				
1958	130,000	135,000	145,000	150,000
1959	152,000	155,000	155,000	155,000
Est. 1960	150,000	150,000	150,000	150,000
FINISHED STOCK ON HAND				
1958	15,000	15,000	10,000	5,000
1959	7,000	12,000	12,000	67,000
Est. 1960	57,000	52,000	52,000	52,000
SHIPMENTS				
1958	120,000	135,000	150,000	155,000
1959	150,000	150,000	155,000	100,000
Est. 1960	160,000	155,000	150,000	150,000

next major problem is planning for orderly materials purchasing. In smaller firms someone in the plant should be given the job of buying materials (1) in accordance with specifications, (2) in the most economical lot sizes and (3) at the most favorable prices considering delivery, terms, service and so forth. Normally, the purchasing department would handle materials purchasing under the direction of the production manager.

▶ **Inventory Control** — Despite careful planning and periodic reviews of material needed, most smaller chemical plants will find it advantageous to work with a maximum-minimum supplies position. By taking into account the time required to get delivery on an item, the average use of the item during that time and the "cushion" stock necessary, it is not difficult to establish maximum-minimum supply levels. It is somewhat more difficult, however, to determine the most economical order since you must calculate the effects of price fluctuations, availability, economies of large commitments and the investment capital involved.

Though formulas are available for calculating the most economical order size, smaller firms seldom use them. By and large, managers of such firms are sufficiently familiar with their problems to be able to estimate fairly accurately the most economical order, especially true when a small plant produces to order.

▶ **Procedures and Records** — A materials control system is only as reliable as the information on which it is based. Therefore, great care should be exercised in setting up suitable procedures and records as follows:

- Be sure that a reliable reporting system is installed to follow the flow of materials from the raw inventory through the entire manufacturing or compounding process, department by department, until it moves into finished products.
- Be sure that someone on the management team (in conjunction with the engineering department, if any) determines what the standards are and also reviews and revises the standards continually.
- Be sure that the accounting department is properly instructed in the recording of the usage of materials.

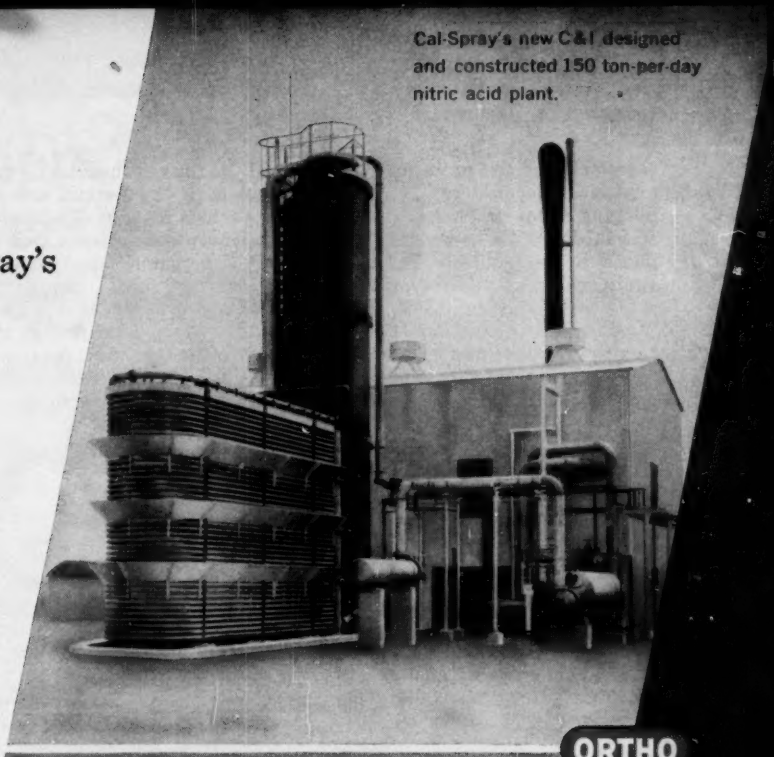
If there is no receiving department, some provision must be made for inspection, storage and recording of materials received. Where practical, recording of materials received should be done at the time it is sent to the storeroom. Also where practical, items should be tagged or otherwise identified to prevent errors later. As for finished products ready to leave the plant, the sales department frequently keeps the records and has the responsibility for finished goods. Therefore, finished products are not usually a factor in a materials control program except as mentioned earlier.

Many storerooms have bin tags for groups of items. These tags identify the stock, the date items were received and issued for production, the quantity and the balance on hand. Stores record cards are also used where there is no central storeroom or where the ease of posting records is preferred.

Developing standards of materials usage is also an important part of a materials control program. Unless you know how much material you should use, control of how much you do use will be ineffective. Setting up acceptable standards involves engineering—how much material, the character of the material (specific gravity, weight, quality, resistance to deterioration) and similar specifications.

You can greatly reduce the

it's C&I again at Cal-Spray's Kennewick Plant



Cal-Spray's new C&I designed and constructed 150 ton-per-day nitric acid plant.

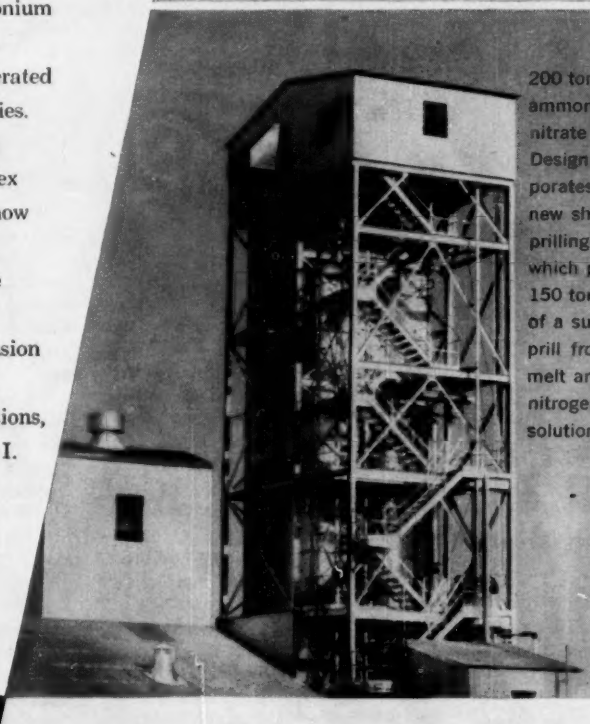
"... beyond expectations"

was the way Cal-Spray described their new nitric acid and ammonium nitrate facilities recently designed and constructed by C&I at Cal-Spray's Kennewick, Washington fertilizer plant. Both the nitric acid and ammonium nitrate plants went on stream according to schedule and operated in excess of their rated capacities.

Also under construction for Cal-Spray is their new complex fertilizer plant designed and now under construction by C&I. It is due to go on stream in the spring of 1960.

If you are considering expansion of present fertilizer facilities or are contemplating new locations, it will pay you to consult C&I. Representatives in principle cities of the world.

ORTHO



200 ton-per-day ammonium nitrate plant. Design incorporates C&I's new short prilling tower which produces 150 tons per day of a superior prill from a melt and nitrogen solutions.

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THE CHEMICAL AND INDUSTRIAL CORP.

CINCINNATI 26, OHIO

Complete Plants

for the production of: ammonia • nitric acid • phosphoric acid • ammonium nitrate • complex fertilizer ammonium phosphate • hydrogen • girbotol gas purification carbon dioxide • synthesis gas • sulphur recovery • carbon monoxide

complexity of the problems with analytical techniques, by simplifying types and sizes, and by standardizing on materials. This phase of an effective program again requires the cooperation of many departments—sales, purchasing and production. Consequently, you may find it desirable to establish a committee. Such a "Materials Standards Committee" may handle not only standardization, but also carry on reviews of inventories, specifications and the like.

When the committee has approved an acceptable bill-of-materials, including substitute materials, specific code numbers should be assigned to each material. Definite specifications (standards) must be established for materials so that quality will not vary. Material codification facilitates reordering, requisitioning and accounting because everyone involved is talking about the same thing.

▶ **Don't Forget Accounting** — The importance of accounting in materials control work cannot be over-emphasized. In large plants, accounting procedures often become complex and involve many forms. But the typical smaller business, with a limited clerical staff, should stick to a simple system.

To insure accuracy of records, many small plants find it practical to take inventory more often than the normal accounting periods require. These physical inventories are taken by stores personnel and checked against the book records. If there are differences, the "book inventory" is corrected to conform to the "physical inventory" and steps are taken to determine the cause of the discrepancy in the "book inventory."

A book inventory (or perpetual inventory) is desirable if records are kept in sufficient detail to present a complete picture of materials. If a firm adopts a perpetual inventory system it should have a planned program for covering all items stocked at least once a year. More important items should be checked more often.

The company should set up a regular review of the manner in which receiving reports, materials issued and stores or stockroom records are classified and posted in accounting records. For example, requisitions are usually sorted by classes of products or by job number and overhead expense accounts in accordance with the way costs are set up. Under a standard cost accounting plan unfavorable variances quickly highlight excessive materials usage. In addition, management is currently informed of material price variances where materials are being purchased above or below prices predetermined for standard cost purposes.

▶ **Program Isn't Everything**—If the firm does an effective job of planning and organizing, of setting up proper procedures and of providing for accurate records, it will have done much to reduce material costs. But materials control will not automatically result. The real effectiveness of materials control depends upon a company's willingness to do something about the facts which an adequate materials control program will reveal.

All the planning, procedures and records in the world will do no more than provide the mechanics for doing things and keeping track of certain kinds of information. You can't save money on materials by having a foolproof inspection system or by observing that prices are rising. The "control" part of materials control hinges upon decisions by someone and instructions to someone else leading to practical action. If the various persons involved are unwilling or unable to make sound decisions or carry out instructions effectively, the materials control program is doomed to failure.

Thus, when inventories are getting out of line—without proper explanations for shortages, hedges against price changes, or plans for unusual expansion and so on—the head of the firm should start corrective action. Through periodic review of inventories, material costs and material usage, he can get the facts he needs for taking steps to control materials more closely. But having first planned, organized and established procedures and records for materials control, he will be able to solve many problems promptly.

ALFRED J. BOHL has been an industrial and management engineer, specializing in manufacturing and processing industries, for the past 25 years. On the plant side, he has had wide experience in plant layout, materials handling, tool designing, production standards, cost estimation and labor control. He has also done much progressive work in operating and financial controls, sales, marketing and distribution.

Operating Men, Share Your Knowledge!

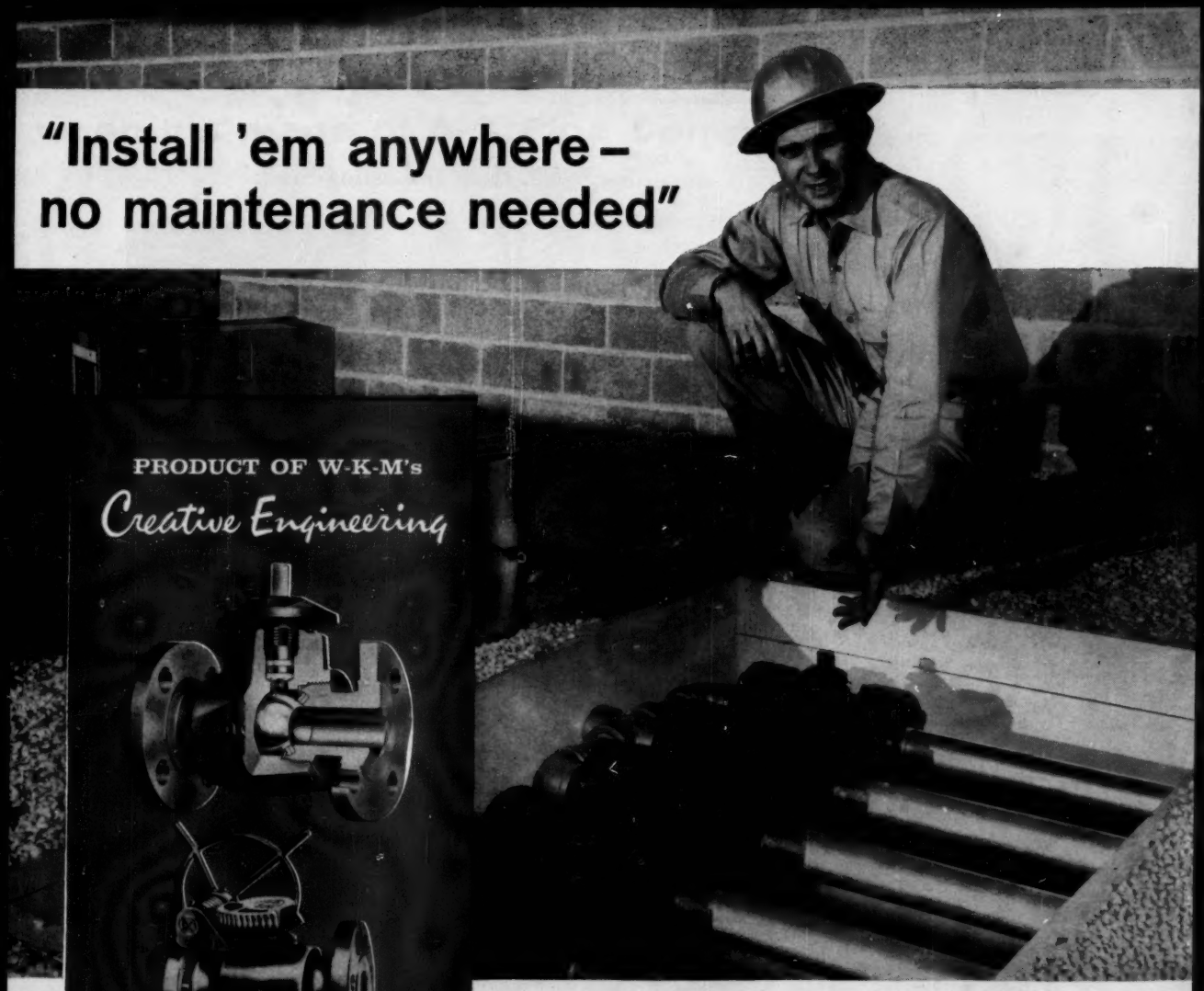
Has it occurred to you operating men that your counterparts in other plants might have the same problems you have? These men would like to know how you handle plant operating problems and how your methods might apply to them. In turn, knowledge of how someone else has handled an operating situation may point the way to the solution of a problem troubling you.

Share your experience and knowledge with your fellow readers. Write an article for Operation and Maintenance. It's easy. Just write 4 to 12 double-spaced typewritten pages on some phase of plant operations with which you are familiar and send it in to us. We will do the rest. You will find that when writing on a familiar subject, the problem is not making it long enough, but making it short enough.

Address articles and correspondence to: Operation and Maintenance, Chemical Engineering, 330 W. 42nd St., New York 36, N. Y.

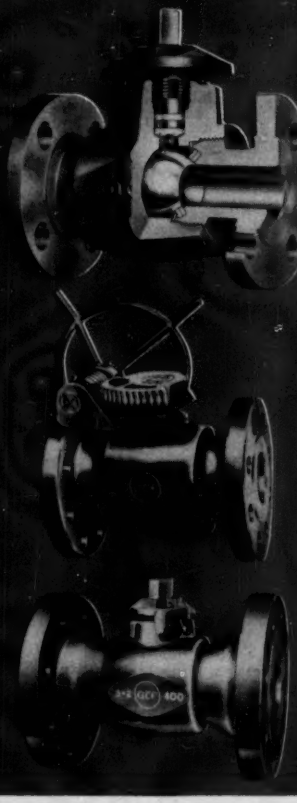
Operation & Maintenance continues on page 212.

"Install 'em anywhere – no maintenance needed"



PRODUCT OF W-K-M's

Creative Engineering



ACF non-lubricated Ball Valves feature Teflon stem gaskets and seats. There's no lubricant to cause sticking or contamination.

Working Pressures: In carbon steel with ASA ratings of 150 pound and 300 pound, and some sizes in ASA 600 pound; in semi-steel with 200 and 400 pound WOG ratings.

Sizes: ½" through 6". Regular port valves up to 8" x 6".

ACF non-lubricated Ball Valves

ACF Ball Valves are not only non-lubricated . . . but designed *throughout* for maintenance-free performance. For example: The ball is suspended between Teflon* seats under compression for leakproof sealing. Seats are protected from the lading flow. And the full bore conduit provides *smooth* flow, with no destructive turbulence . . . no more pressure drop than through an equal length of pipe.

A quick quarter-turn operates this rugged valve. Specify it. You'll get efficient, economical performance. *Available from leading suppliers everywhere.*

* Du Pont Trademark

WRITE FOR CATALOG 1000

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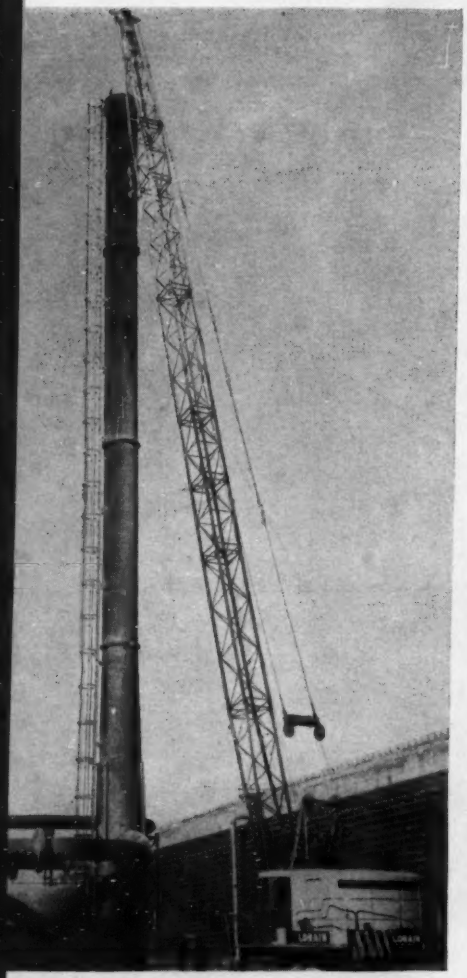


CRANE BOOM length limits height of stack that can be inspected.

Superman? No. Man Inspecting Stack

Crane Speeds Stack Inspection, Eliminates Expensive Scaffolding

There is really only one way to inspect the inside of a stack—put a man inside of it. That's what these people are doing at American Oil Co.'s Texas City refinery, but they are using a somewhat different approach.

It used to be that you built a scaffold on top of the stack, then rigged the tackle on the platform or edge of the stack with a line running to a winch on the ground for raising and lowering a bosun's chair with a man in it—often a young, green, adventurous engineer who didn't know any better.

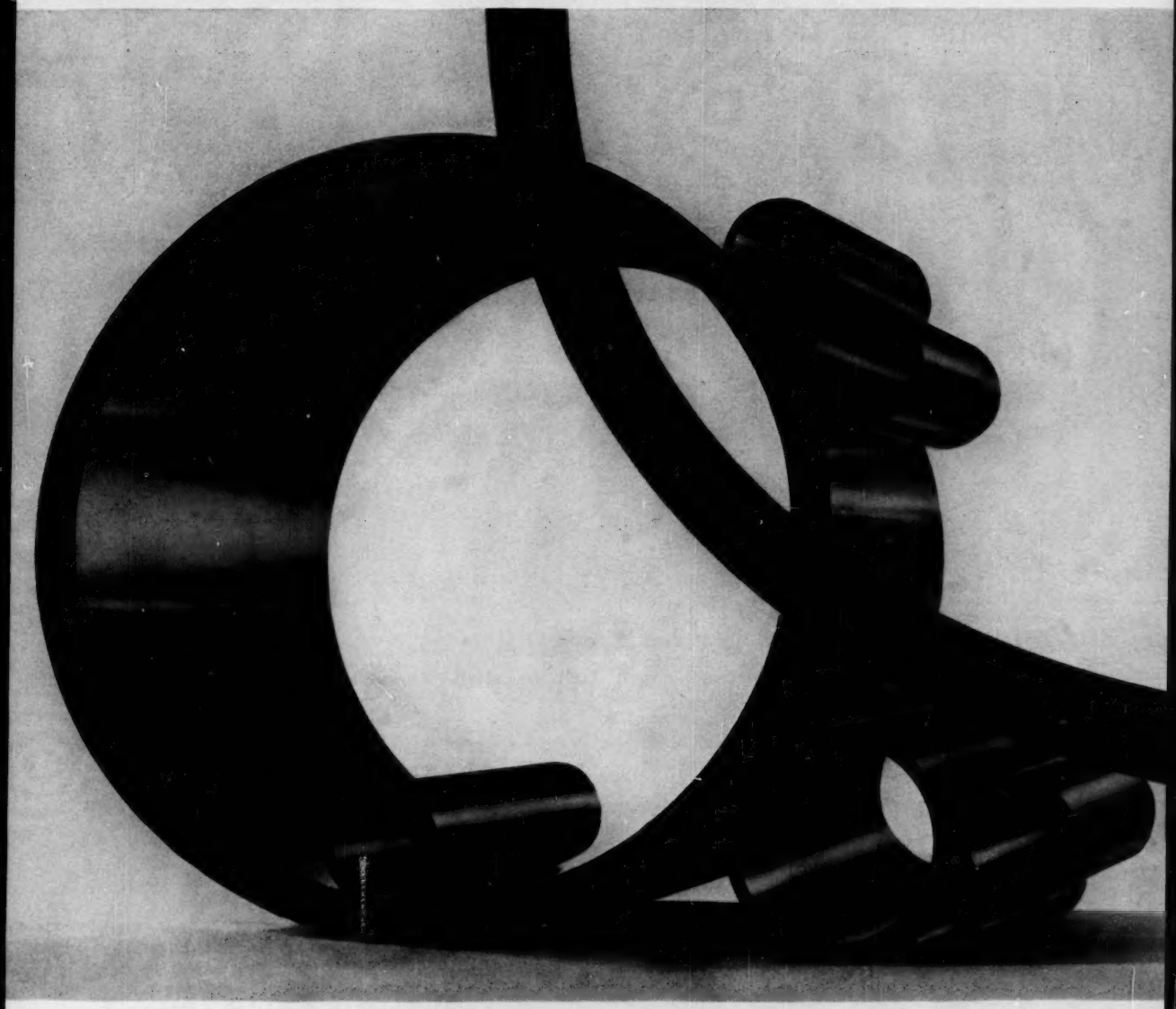
Disadvantages of the old method are fairly obvious—construction of the scaffold is expensive, time consuming and possibly dangerous. Once the rig is set up, it is fairly restricted—the inspector cannot easily take a close look at something interesting on the other side of the stack without rerigging the chair.

Amoco's method, shown in the pictures, is a lot simpler. They rigged a bosun's chair on a crane of suitable length to top this 120 ft. blow-down stack on their No. 1 thermal cracking unit. Then they just put a man in the chair, lifted him up and dropped him into the stack. Both the crane operator and the inspector wear earphones and chest microphones so that the inspector is in constant communication with the ground. On command, the crane operator can put the inspector anywhere he wants to be when he wants it—no more rerigging. He can even report his findings to someone on the ground, thus freeing both his hands for himself.

This method is a lot quicker than the usual one and much more flexible. One problem remains to be solved, however. Where do you find a young, green, adventurous engineer who doesn't know any better?

EARPHONES and mike allow constant communication with inspector.

you can lay plastic pipe and forget it... when it's made of A-C® Pipe Compound



It's a fact! Now you can buy plastic pipe that's virtually trouble-free! It's made of A-C Pipe Compound, a super-strong polyethylene resin designed to last 50 years—and actually covered by manufacturers' *warranties* for 20 years or more!

This pipe offers tremendous surge strength and complete freedom from slitting or pinholing. It is the *only* flexible plastic pipe available today that is entirely free from environmental stress cracking.

Note how this glossy premium pipe is shiny *inside* as well as out! It will not rust, rot, or corrode, and has excellent resistance to acids and alkalies. It withstands sub-zero temperatures, is lightweight, flexible, easy to install.

Pipe made of A-C Pipe Compound assures lasting performance in jet wells, water transmission, chemical and food processing. N.S.F.-approved and nontoxic, it's suitable for dozens of uses in home, farm or industry. For the names of manufacturers, or for sample test lengths, write us today.

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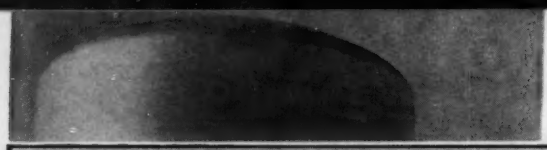
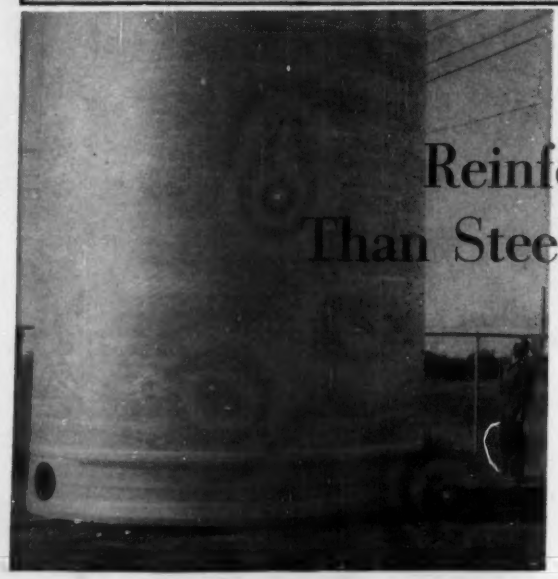


PRACTICE . . .

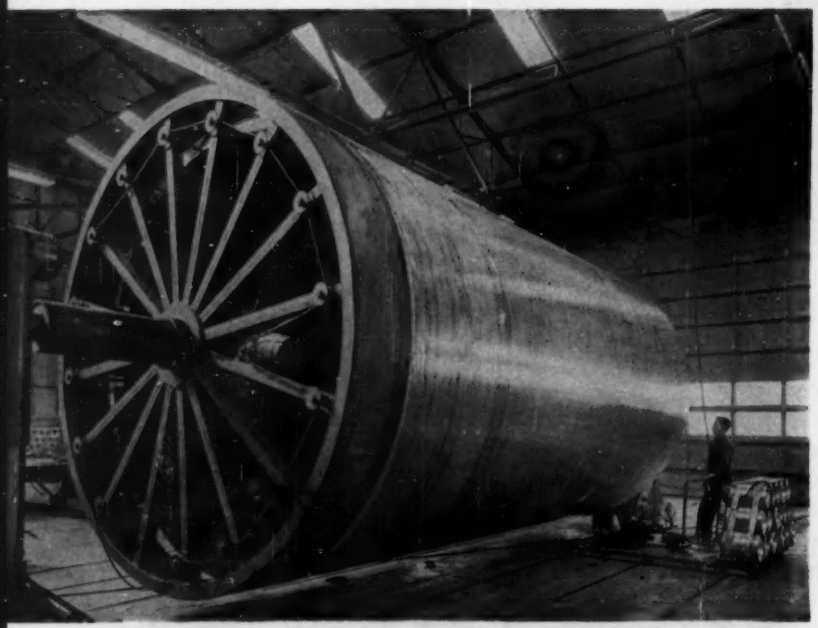
CORROSION FORUM

EDITED BY R. B. NORDEN



Reinforced Plastic Better Than Steel for Storage Tanks

Missile-proved machine technique makes strong, resistant plastic vessels, equal in cost to steel.



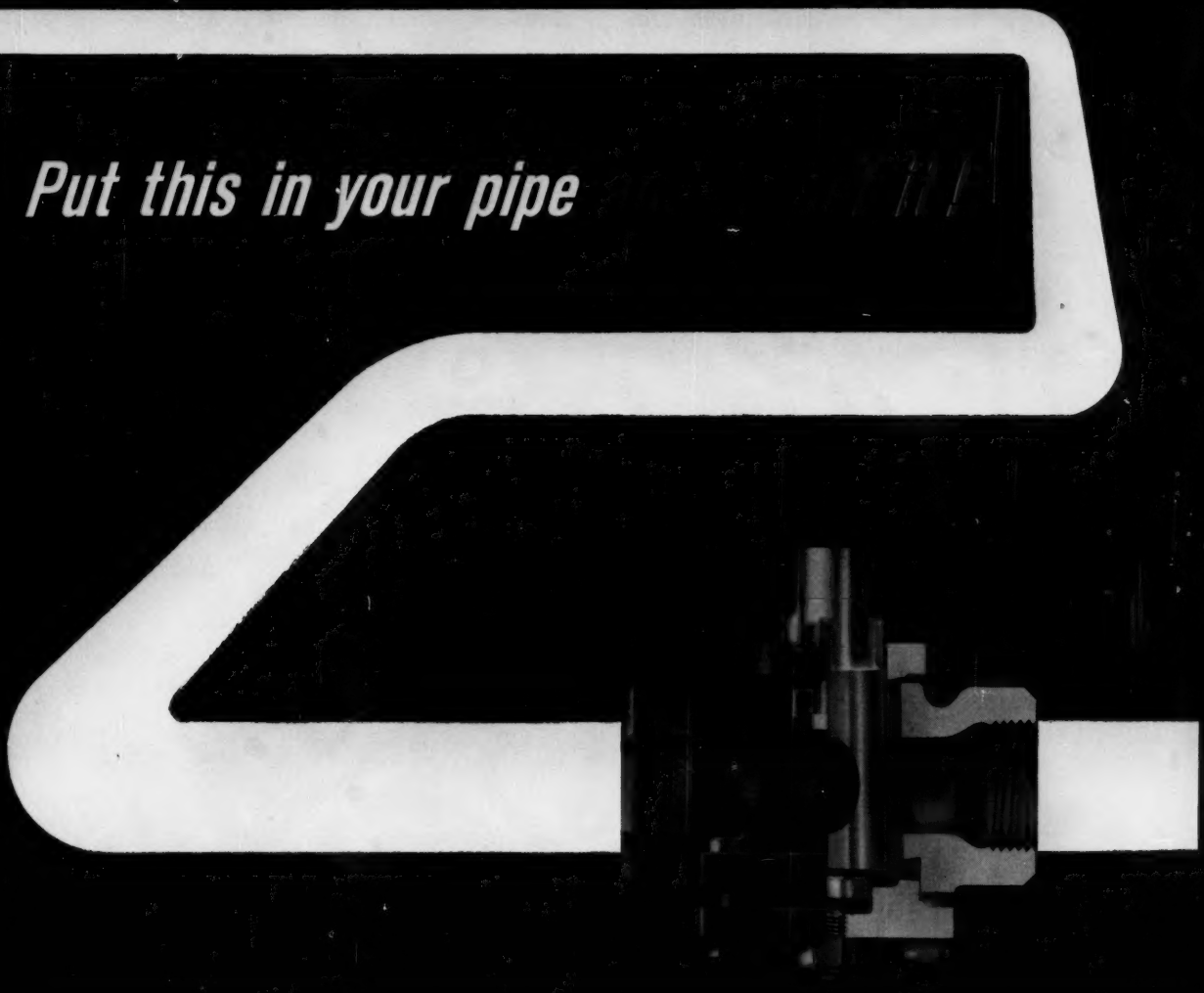
FILAMENT-WINDING machine produces uniform plastic structure.

To whip innumerable corrosion and maintenance problems, a major producer of steel and wooden storage tanks will soon introduce a unique line of large, resin-bonded, glass-fiber vessels to the chemical process industries.

Drawing on knowledge gained through long experience in designing and producing storage tanks for the oil industry, Black, Sivalls & Bryson, recently developed a filament-wound epoxy-bonded fiber-glass vessel now undergoing field tests. Filament winding eliminates much of the hand labor associated with usual plastic construction. Production will start soon on a line of 10-ft. and 12-ft. dia. vertical tanks made entirely of this material. They will be 15 to 24-ft. high with capacities of 12,600 to 20,000 gal. (*tank upper left is 12 by 20 ft.*).

BS&B estimates an internally coated steel tank, storing sour crude oil under average conditions, may hold up for only two or three years before the coating has to be repaired—even the best coating can have imperfections and pores, allowing corrosion to set in. An epoxy-glass tank, which doesn't require any coating, should hold up indefinitely. And a 10-ft. or 12-ft., 0.125-in.-thick plastic vessel will cost

Put this in your pipe



Get Durco Sleeveline Type F non-lubricated plug valves for your most severe corrosive or erosive services

You can handle acids such as sulphuric, hydrofluoric and nitric; solvents, caustics, chlorine gas or liquid, chlorinated organics, plastic resins, high vacuums and corrosive slurries with little or no maintenance problems.

Durco Type F valves are available in Durimet-20, 316 Stainless, Monel, Chlorimet-2, Chlorimet-3, and Nickel. Flanged or screwed, in sizes from ½" to 6". 2 or 3 way design, 150 psi and 300 psi ratings.

Write today for informative Bulletin V/4b.

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CORROSION RESISTING ALLOYS & EQUIPMENT

THE DURIRON COMPANY INC., Dayton, Ohio / Valves • Pumps • Filters • Process Equipment

Reinforced Plastic Produced by Machine Filament Winding: Light and Strong

Properties at Room Temperature	Tank Materials		
	Filament-Wound Glass-Epoxy	Aluminum* 5454-H34	Structural Steel*
Density, lb./cu. in.	0.072	0.096	0.283
Tensile strength, 1,000 psi.	130 (Helical) 200 (Unidirectional)	44	45–65
Strength-weight ratio (tensile strength/density)	1,808,000	458,000	159,000–230,000
Modulus of elasticity, psi. × 10^6	3 to 6	10	30
Service temperature range, °F.	−65 to 250	−320 to 300	−50 to 750
Thermal conductivity, Btu./(hr.)(sq. ft.)(°F./in.)	2.5	930	320
Coefficient of expansion, in./in./°F. × 10^{-6}	5 to 6	13	6

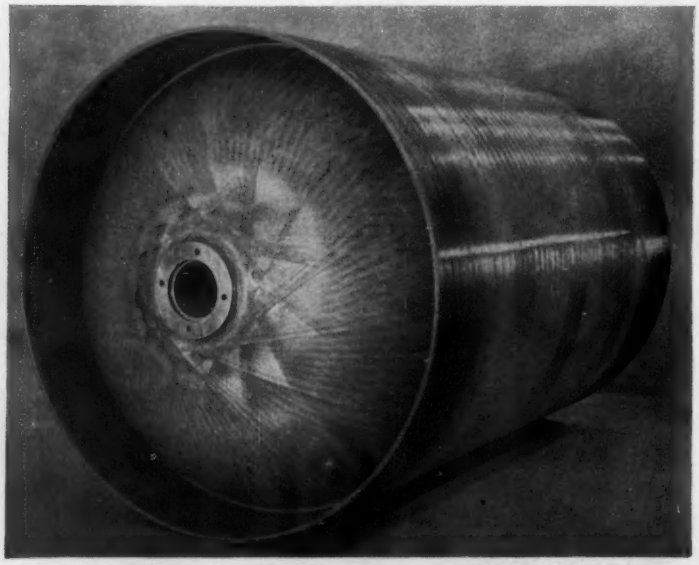
* Of course much stronger aluminum alloys and steels are available, but they are not used in tank construction.

about the same as a similar tank of ¼-in. steel with protective coating.

▶ **Rocket Background**—The new tanks bear only a superficial resemblance to the usual reinforced-plastic equipment now made in this country. BS&B is licensed to use the filament-winding method patented by Young Development division of Hercules Powder, which produces a very strong structure (*see table*). This same technique is used for making process pipe (Americoat's Bondstrand) and for solid-fuel rocket cases. This is its first application in the production of large storage vessels.

Majority of large-scale reinforced-plastic equipment on the market (except for pipe) is produced by some form of molding process using glass mats, cloth or woven roving. Multiple layers of fiber glass are impregnated with resin, then cured. This involves a lot of hand labor.*

*A recent modification of this technique calls for wrapping steel cable around a plastic tank. The producer claims this permits a relatively low factor of safety in reinforced-plastic construction—sometimes plagued by inadequate engineering data. In this design steel cables carry a good part of the load.



ROCKET MOTOR casing (500 psi.) experience paved way for tank method.

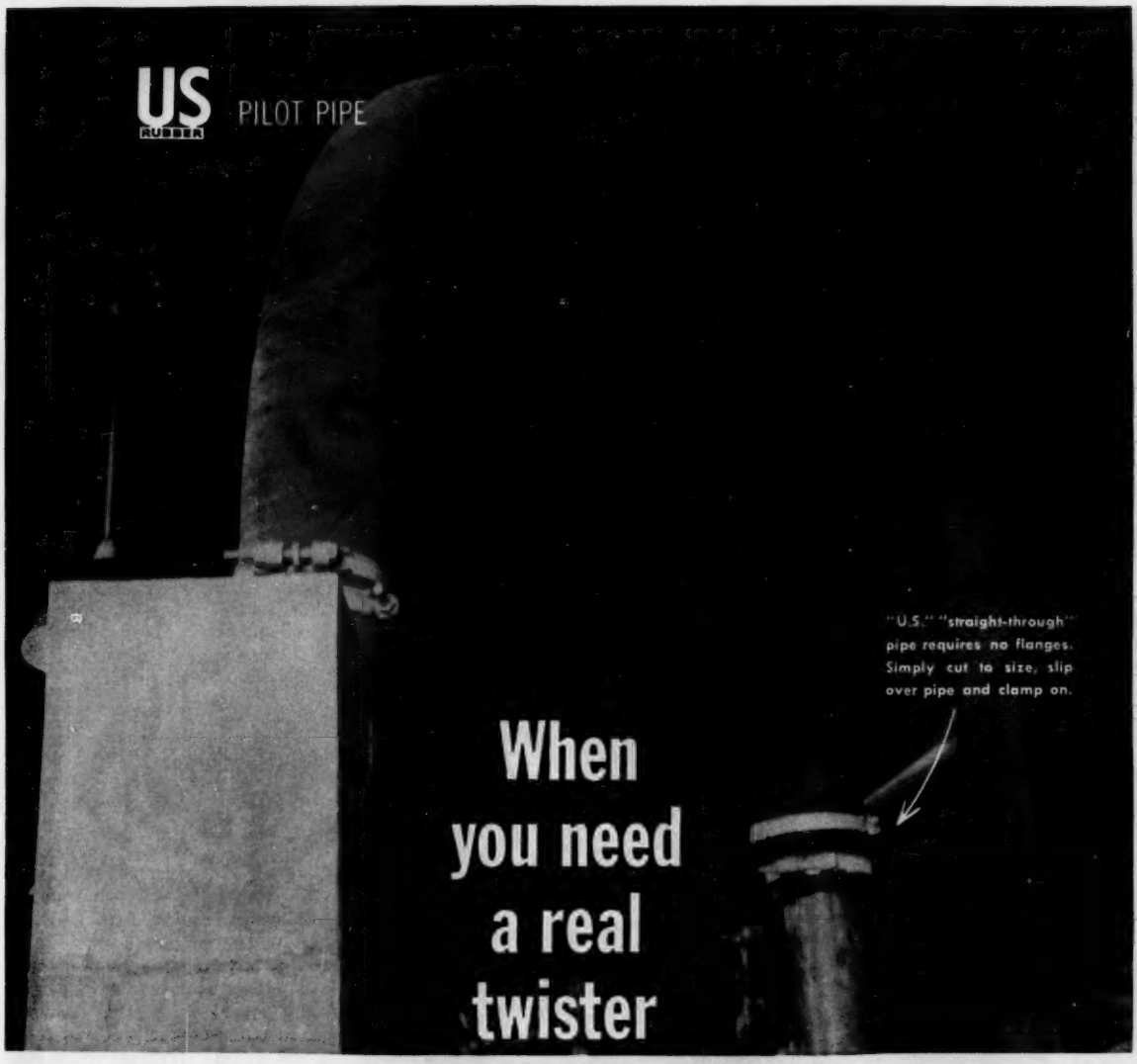
But BS&B's technique is a machine operation: a large number of continuous glass filaments (actually a band) are helically interwoven mechanically under tension, around a polished mandrel in the shape of the finished part, by a special control device. Each filament is coated with epoxy resin and layers of resin-coated glass build up. The tank is then heat cured, forming a dense, composite, uniform structure.

Winding geometry, which must be carefully designed and controlled, plus use of continuous, oriented glass filaments, produce a vessel which is stronger than that produced by mat or cloth impregnation. Resin-glass density is about ¼ that of steel and tank walls need be only ½ as thick.

▶ **Tank Details**—In the process, shell and head are wound as an integral structure. Shell wall is 0.125-in. thick. Bottoms are molded of a mat material similar to the shell, with a special flange construction.

Actually, the tanks are nominally designed for atmospheric pressure (bottoms, of course, will be subjected to a liquid head pressure). But they can take considerably more than 14.7 psia. Walls are in the 90,000 to 115,000 psi. ultimate-tensile-strength range.

Repairs on the resin-glass vessel, should they become necessary, present no serious problems. The area to be repaired must be thoroughly cleaned. Then a patch of reinforced glass-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- Maintenance is nil.
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U. S. Pilot Pipe includes a wide range of designs ("straight-through", duck and rubber flanges, swivel flanges) that handle a wide range of working pressures—from 25 to 250 pounds—and also handle a wide range of chemicals and abrasives.

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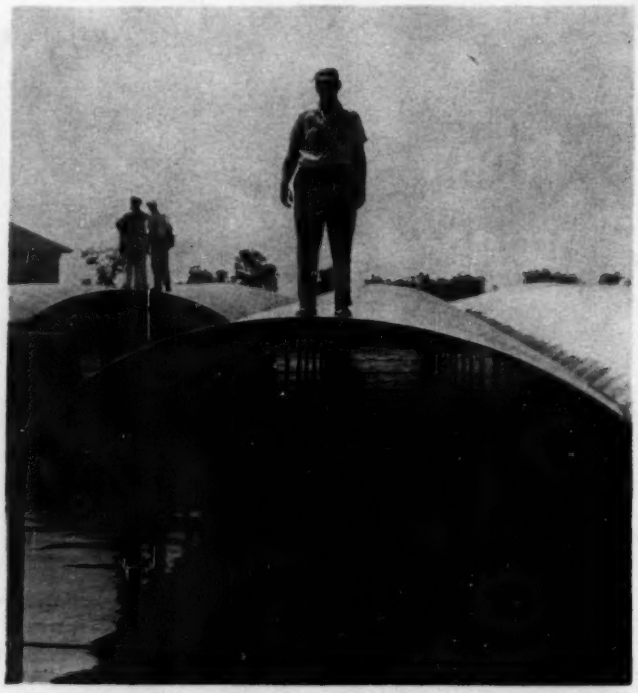
fiber material, impregnated with catalyzed epoxy resin, is applied (see *Chem. Eng.*, Jan. 27, 1958, p. 148). The tank doesn't suffer from an appearance standpoint since the patch can be applied on the inside.

▶**About Liners** — Filament-wound pipe, containing about 80% glass, has a lining of epoxy resin to increase chemical resistance—liner is heat cured with the body of the pipe. BS&B's tanks will have a Dynel-felt or other suitable liner. However, this will not always be necessary. Instead, glass content could be dropped to 70%, giving a resin-rich structure impervious to water. Tests have been run for over 12 months on two tanks, one lined, the other unlined, with hot water entering at 190 F. and exiting at 170 F. To date there is no indication of leaks or water penetration on either tank.

▶**Some Limitations** — This doesn't mean, of course, that the new tanks can handle any situation. Epoxy-glass is good for dilute mineral acids and alkalis, most salt solutions and practically all types of petroleum products (crudes, gasoline, diesel oil). But it's not good against strong acids or alkalis. And its temperature limit is approximately 250 F.

Nevertheless, the machine filament-winding technique gets around one of the biggest disadvantages of reinforced-plastic equipment: quality variations due to hand operations.

Armed with what it believes is a winning combination of technique and composition, BS&B expects to produce these storage tanks, as well as a range of miscellaneous tanks and rocket motor cases, with machines capable of depositing 600 lb./hr. of resin-glass.



Aluminum Arches Protect Water Supply

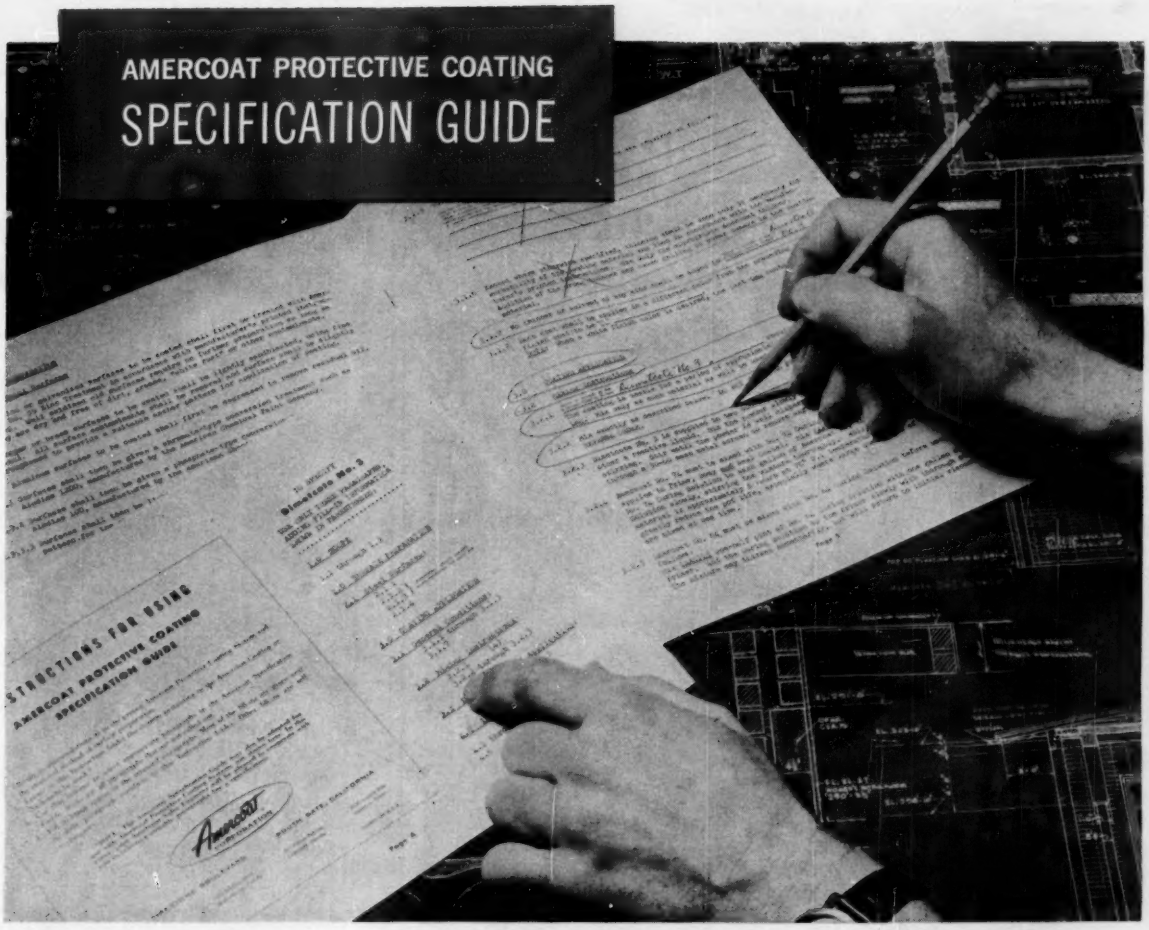
An aluminum roof of no small dimensions protects a Pawtucket, R. I., water reservoir from heat and contamination. The problem was equivalent to covering a 20-million-gal. storage tank. Kaiser Aluminum's answer: 150,000 sq. ft. of 0.032-in. alclad-alloy-3004 arches that don't require inside supports. Each arch edge rests on 8-in. flange beams; gutters are grouted with cement. Aluminum has a heavy coat of bitumastic paint only where it comes in contact with steel or concrete. Cost of roof and supporting structure: $1.34/sq. ft.

International Corrosion Congress Invites Papers

The first international congress on metallic corrosion will take place in London, Apr. 10-15, 1961. A committee is now organizing technical sessions for the congress and invites papers on any aspect of metallic corrosion from laboratories throughout the world. Original work is of prime interest, but first class review papers will be welcome.

Title and synopsis must be submitted before Apr. 30, 1960 and completed manuscripts before Aug. 31, 1960. Papers, synopsis, and correspondence regarding papers should be sent to Hon. Secretary of the Scientific Committee, Mr. H. S. Campbell, The British Non-Ferrous Metals Research Assn., Euston St., London, N.W.1. Send all other correspondence to Hon. Secretary, 1st International Congress on Metallic Corrosion: London 1961, 14 Belgrave Square, London, S.W.1.

Preprints will be issued well before the Congress and authors will be invited to introduce their papers briefly for discussion. All papers and discussions will be published in book form following the meeting.



Here's the Beginning of a Good Coating Job

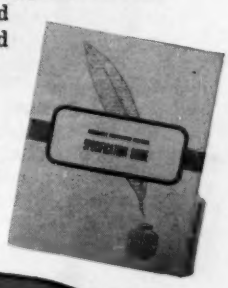
Tight, comprehensive specifications are the beginning of a successful protective coating application. Unless specifications are complete and detailed, costly failures or confused, inaccurate bidding can result.

Now, engineers who write specifications for protective coating applications can insure complete, accurate specifications through use of the new Amercoat Protective Coating Specification Guide.

The Guide is based on recognized best practices in the industry, such as Steel Structures Painting Council Specifications, and contains paragraphs covering all phases of coating application from surface preparation to inspection.

In use, appropriate paragraphs in the Guide are selected according to the coating to be used and the condition involved. At this step, your Amercoat Sales Engineer will be pleased to cooperate with you in deciding upon the most effective coating or coating system for the job requirements. The finished specifications can then be copied by a typist.

Use of the Amercoat Specification Guide assures tight specifications that spell out every step necessary to eliminate confusion when the contractor bids and to insure a satisfactory application later. Job delays and extras are reduced or eliminated and a well applied coating job is assured.



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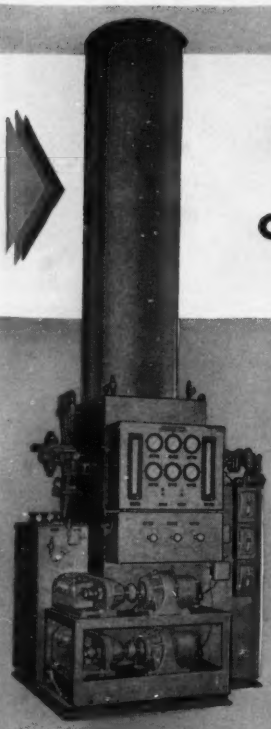

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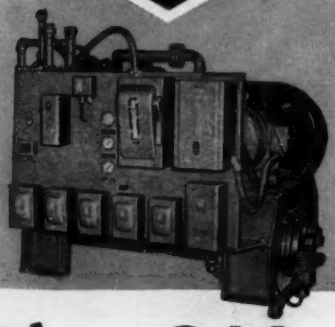

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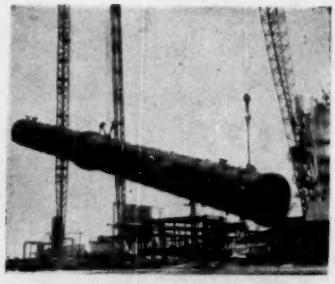
INDUSTRY NEWS . . .

(*Continued from page* 102.)

Aluminum Co. of America readies itself for rising aluminum demand by increasing capacity at Point Comfort, Tex., from 100,000 to 120,000 tons/yr. of primary metal. Construction of this addition began some two years ago, but was halted because of aluminum oversupply.



British American Oil Co. prepares to install a 154-ft.-tall, isostripping tower at its Clarkson, Ont., refinery; new tower is part of an alkylation unit to upgrade gasoline octanes. Slender gin poles will support the 12-ft.-dia tower, that weighs 130 tons.

Chippewa Plastics Co., a major producer of polyethylene film, has begun forming polypropylene film at Chippewa Falls, Wis. Chippewa acclaims the high-performance characteristics of new polypropylene film.

Copolymer Rubber & Chemical Corp., Baton Rouge, La., makes its contribution to the butadiene boom, adds another $5-million to its current $3-million expansion plans. When the entire project is completed in May 1961, butadiene capacity will be increased by 50%. New capacity will employ Dow's new Type-B catalyst to wring out higher product yields from currently used feed stock.

Houston Chemical Corp., a subsidiary of Chatham Chemical Corp., New York, N. Y., plans construction of a $12-million ethylene glycol plant at Beaumont, Tex. Houston Chemical will purchase ethylene feed,

from Mobile Oil, who is building a $25-million high-purity ethylene plant, adjacent to the Houston Chemical plant.

General Electric Co. reports rapid progress towards the completion of its giant polycarbonate plant near Mount Vernon, Ind. Commercial plant represents scale-up of pilot and semi-works units at Pittsfield, Mass.

Witfield Chemical Corp., a new joint venture of Witco Chemical and Richfield Oil, steps into the detergent-chemical picture with plans for a $1.75-million dodecylbenzene plant. Witfield selects Richfield's Watson refinery in Los Angeles, Calif., as plant site; Richfield will supply benzene and propylene tetramer feed stock and Witco will market product.

Witco Chemical Co. announces another advance into the detergent field: Ultra Chemical Works, Inc., a Witco subsidiary, plans construction of a 15,000-ton/yr; dodecylbenzene sulfonate plant at Witco's Chicago, Ill., plant.

Phillips Chemical Co., a subsidiary of Phillips Petroleum, meets rising ethylene demand on the Texas Gulf Coast head on with new expansion plans. Current 145,000-ton/yr. capacity will be doubled by fall-1961 at Sweeny, Tex.

B. F. Goodrich Chemical Co. will up vinyl resin and compound capacity, with construction of new facilities at Long Beach, Calif. C. F. Braun will design and con-

DAY

Pneumatic Conveying & Bulk Storage News

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The photograph below shows RMC Pressure Gauges undergoing severe vibration testing on big Calidyne High Frequency Vibration Test System. These gauges undergo accelerated tests from 0-2000 CPS—up to 25 G intensity and up to 350° F.

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With its direct drive, there are no gears or linkage to gyrate and score on vibration—no unbalanced bourdon "C" springs and hair springs to whip. Direct-drive action means a stable pointer—no loss of power, too. Pointer action of the RMC gauge is steady, positive and alive—no need to tap the gauge to read. Soft hair springs and backlash springs are not used.

Shown at far right is the pointer-coil unit used in 3″ and 5″ concentric models. The pointer in these models is attached directly to the end of the pressure element. At the near right is a cutaway view of the compact 1½″ and 2″ eccentric models. The pointer in these models is actuated directly by a simple pivot. Both types offer the same direct-drive, helical bourdon advantages. Pressure ranges from 0-1000 to 0-10,000 psi.

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RMC

LIQUID LEVEL, TEMPERATURE and PRESSURE INSTRUMENTS

ROCHESTER MANUFACTURING CO., INC., Rochester, N.Y.

struct production and ancillary facilities, with completion scheduled for July.

Heyden Newport Chemical Corp. will soon begin construction of a 24,000-ton/yr. tall-oil refining plant at Oakdale, La. Newport Industries div. will market tall-oil rosins, fatty acids and distilled tall oils to paper and paint industries.

American Laboratories, a div. of American Electronics, Inc., completes installation of this giant liquid-carbon-dioxide distribution systems at its Fullerton, Calif., plant. System consists of a refrigerated and pressurized storage vessel, that stores some 22 tons of liquid CO_2, and an insulated distribution and metering system. Cardox, div. of Chemetron Corp., Los Angeles, Calif., designed and installed the system.

Cooperative Farm Chemicals Assn. has just placed on stream its 120-ton/day nitric acid plant at Lawrence, Kan. Nitric acid output will go to ammonium nitrate fertilizer production, to meet member needs. New nitric acid plant was designed and constructed by Chemical Construction Co., New York, N. Y.

California Spray-Chemical Corp. will complete its new liquid and dry fertilizer plant at Kennewick, Wash., next month. New plant will supply the Pacific Northwest and Mountain States with a complete line of agricultural chemicals.

Northwest Petro-Chemical Co. has placed on stream its

products extraction plant at Anacortes, Wash. NPC will extract phenol, acrylic acid and xylenol from spent caustic shipped from nearby Mobil, Shell and Texaco refineries. Local plywood-resin industry and Japanese companies plan to purchase extract products.

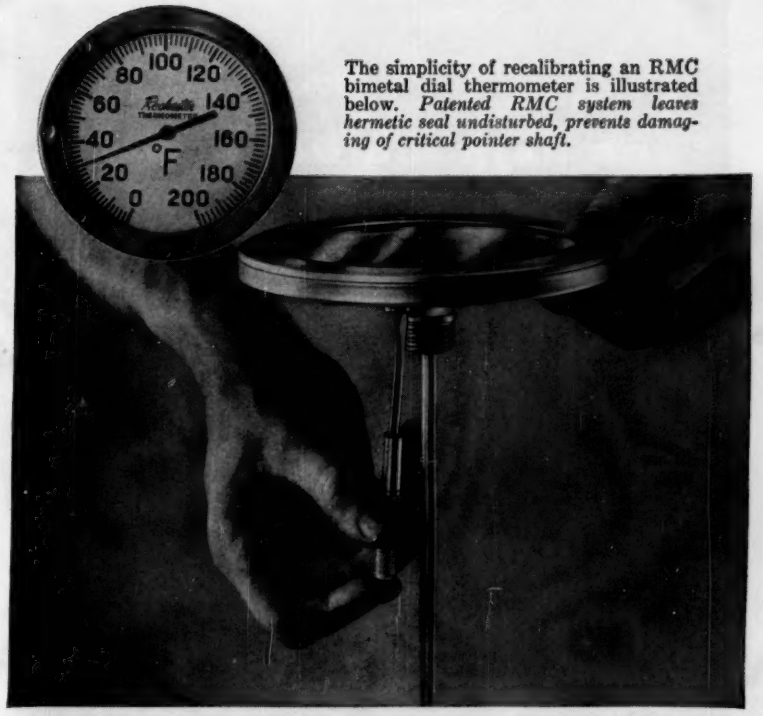
Dow Chemical of Canada announces plans for construction of an ethylene products plant at Fort Saskatchewan, Alta.; construction site was chosen long ago for a Dow chlorine-caustic plant, but discovery that brine reserves are weak halted plans. Dow now plans to produce ethylene oxide, ethylene glycol and ethanolamine from natural gas or separated LPG.

Air Reduction Sales Co. has just started up its newest air separation plant at Fairfield, Ala. New plant, that cost "millions", produces more than 30 tons/day of liquid oxygen, nitrogen and argon for metal refining, welding, rocket components, food processing and electronics industries.

Hooker Chemical Co. is back in the race for Mexican phosphates markets, with completion of its 20,000-ton/yr. Mexican plant. Hooker thus hopes to regain its contracts with Mexican soap makers, which it lost to Monsanto during recent border troubles; Monsanto won sales contract by building a 30,000-ton/yr. plant, south of the troublesome border. Net effect may be price waring of a sort.

Continental Carbon Co. has upped furnace carbon black capacity at Westlake, La., by 12,500 tons/yr.; now total capacity has reached the 22,500-ton/yr. mark. Witco Chemical remains world-wide distributor of Continental carbon blacks.

Columbian Carbon Co., New York, N. Y., reaches for Canadian markets, plans to construct a 20,000-ton/yr. furnace-black plant near



The simplicity of recalibrating an RMC bimetal dial thermometer is illustrated below. *Patented RMC system leaves hermetic seal undisturbed, prevents damaging of critical pointer shaft.*

RMC external recalibration device saves time and your thermometer

With the patented RMC dial reset screw you can recalibrate your thermometer easily and safely, should it ever be necessary. The all-important hermetic seal cannot be destroyed, and there is no chance for damage to the critical pointer shaft.

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Sometimes it is necessary to recalibrate industrial thermometers due to severe shock from rough handling, or to calibrate for extreme accuracy at any point on the scale for special work range.

Various recalibration systems are employed in the different makes of ordinary bimetal thermometers. Most all of them will achieve the desired recalibration, but a number of undesirable things may also result. In some, all semblance of air-tight seal is automatically destroyed in removal of the dial glass. In others, the critical pointer shaft may become bent or twisted. And still others use a mechanism incapable of holding the new setting for any length of time. *None of these things can possibly happen with RMC's patented recalibration device.*

A simple dial-reset screw, located on the back side of RMC thermometers, permits recalibration without opening the instrument in any way—thus leaving its air-tight hermetic seal intact. Its positive meshed-gear mechanism rotates the dial itself in a way that cannot under any circumstances cause damage to the pointer shaft. And the new setting will hold indefinitely.

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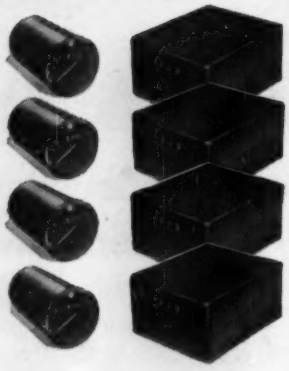

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Toronto, Ont. Columbian Carbon (Canada) Ltd. will operate the new plant, scheduled to start up by 1961.

Sylvania Electric Products plans a $500,000-expansion of germanium and silicon single-crystal capacity at Towanda, Pa. Sylvania's Chemical and Metallurgical Division will operate the new equipment for vertical, horizontal zone melt production of single crystals.

Continental Oil Co. plans to dig in, reveals plans for an underground cavern at Ponca City, Okla., to store 200,000 bbl. of propane gas. Continental has drilled a 4-ft.-dia. shaft into the limestone formation and is now excavating at the 350-ft. level; ultimately, cavern will consist of a series of tunnels, 20-ft. tall and extending radially from the central shaft.

Canadian Industries, Ltd., steps into the polyethylene-film picture, plans construction of a new film plant at Brampton, Ont. Newly acquired Mastex Industries, Ltd. will operate the new plant.

General Services Administration announces successful disposal of the idle Manteca, Calif., magnesium plant. David Weisz and Milton Wershow, Los Angeles auctioneers, submitted an acceptable bid of $7,320,000 for the entire plant, complete with smelting facilities on an 80-acre site.

GSA concurrently opens bidding for the San Jacinto Ordnance Depot, near Houston, Tex. Depot consists of 5,200 acres of industrial site along the north side of the Houston ship channel, two deepwater docks, some 40 mi. of railroad and an am-

monia plant, now leased to Smith-Douglas Co.

Vick Chemical Co. adds another to its line of medical products with acquisition of Clearasil, Inc., White Plains, N. Y. Clearasil markets the largest-selling specialty products for treatment of acne and other dermatological difficulties.

S. C. Johnson & Son reveal their realization of rising demand for wax products in Italy, with the formation of S. C. Johnson & Son Italiana S. p. A. in Milan, Italy. New firm will market floor polishes, waxes and other home and auto-care products.

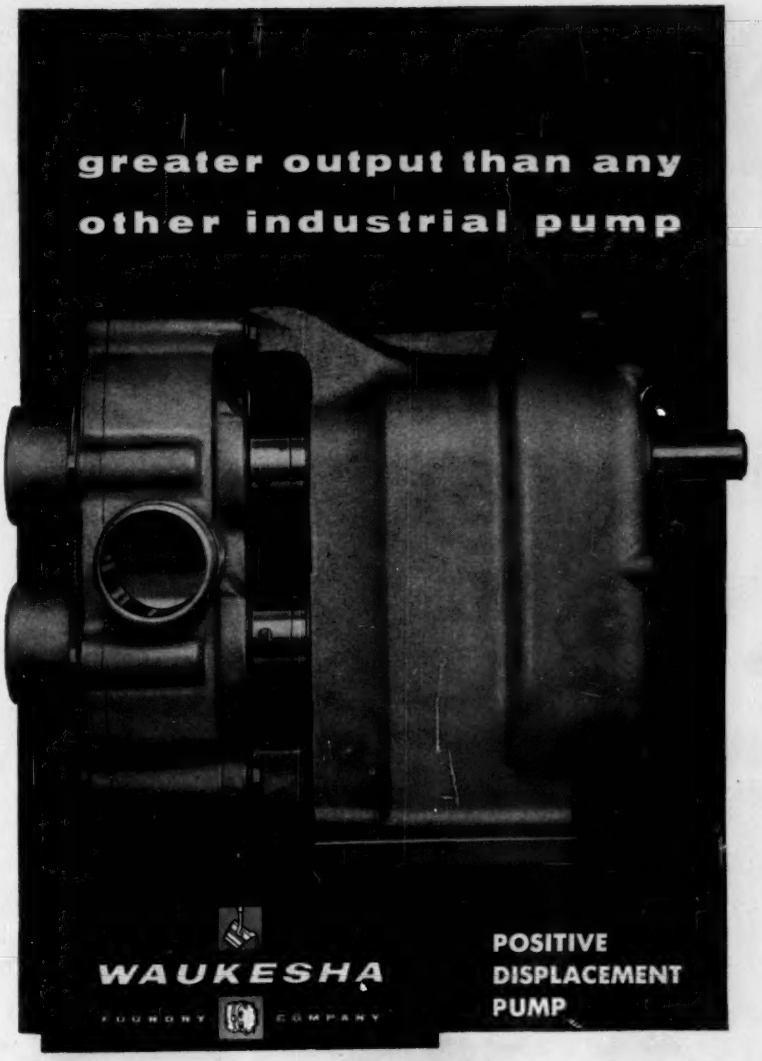
Tidewater Oil Co. extends its marketing interest into the South with the purchase of three distributing companies in North Carolina: Warren and Brantley Oil Co. of Spring Hope., Warren and Brantley Oil Co. of Rocky Mount and Warren Oil Co. of Louisburg.

Borg-Warner Corp. places its BJ Electronics plant in a position of new importance with the formation of the Borg-Warner Controls Div.; new operation will center at the Santa Ana, Calif., facilities of BJ Electronics. New division will work closely with the Borg-Warner subsidiary, Weston Hydraulics, Ltd., manufacturer of pneumatic controls.

Allied Laboratories moves south of the border, announces the acquisition of Establecimientos Francimex, S. A., Mexico City, Mexico. Francimex fits well into the Allied pharmaceutical business.

Northrup Corp. announces acquisition of the Military Products Div. of American Radiator and Standard Sanitary Corp. Northrup will add the new military business to its current list of U. S. Navy and Dept. of Defense contracts.

Robertshaw-Fulton Controls Co., Stratford, Conn., an-



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nounces acquisition of the Microsen instrument business of Manning, Maxwell & Moore, Inc. New line of instruments will be included in the product portfolio of Robertshaw's Aeronautical and Instrument Div., Anaheim, Calif.

OVERSEAS BRIEFS

East Germany: Two major British processing companies, Humphreys A. Glasgow, Ltd., and Petrocarbon Developments, Ltd., have signed an agreement with East Germany's government for the design and construction of a 40,000-ton/yr. ethylene plant. Contract agreement resulted from the 1960 amendment to the 1959 trade agreement between the Federation of British Industries and East Germany's Chamber of Foreign Trade.

Hawaii: Permanente Cement Co. positions this giant, 450-ft.-long kiln at its new Honolulu plant; kiln, measuring 12 to 14½ ft. in dia., rests on its supporting piers.

England: Imperial Chemical Industries, Ltd., announces plans to construct its gigantic Severnside Chemical Works on a 1,000-acre site at South Gloucestershire; chemical complex, when completed, will match the ICI Wilkins Works in size and cost. First

You can afford to do it better for less

IT'S THAT SIMPLE!

By having your shell and tube heat exchangers and condensers designed around Wolverine Trufin® Type S/T, you actually can, in many cases, afford to replace admiralty tubing with higher grade alloys such as cupro-nickel.

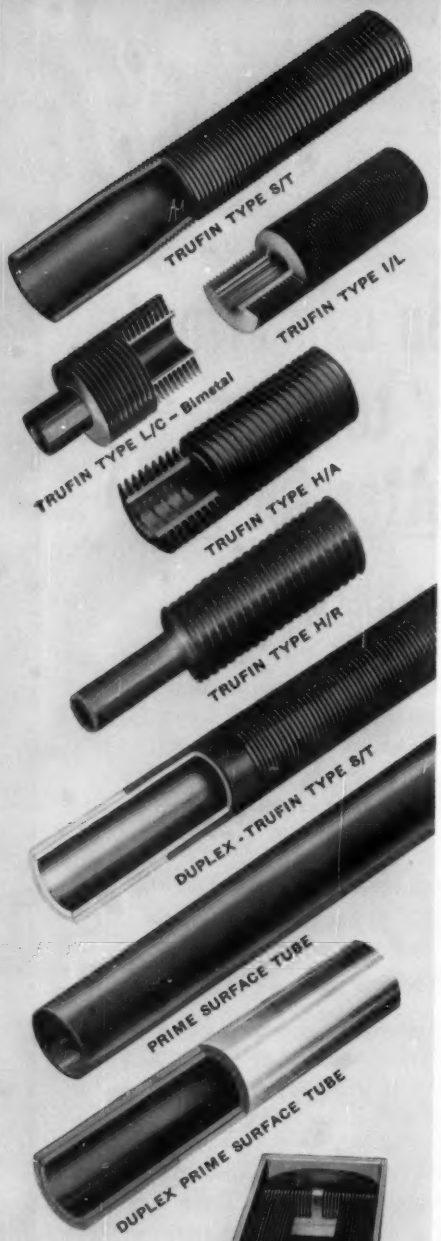
The result is a unit with greater resistance to corrosion and erosion—one that will stay on stream longer with a minimum of maintenance.

The answer, of course, comes from the greatly increased surface area gained by Trufin Type S/T because of its integral fins.

These fins are actually squeezed from the tube wall and give Trufin Type S/T as much as 2½ times more surface area than a comparable piece of plain tube. As a result, you handle more BTU's per foot of tube, thus use fewer tubes, smaller shells, headers and baffles and, in the case of overhead units, less structural support.

For complete information about how Wolverine Trufin Type S/T can help you do a better job for less, just write for your copy of the Trufin Catalog. Or better still—

Ask your Wolverine Salesman.



U-BEND PALLETS

Only Wolverine Tube can offer all these extra condenser tube values

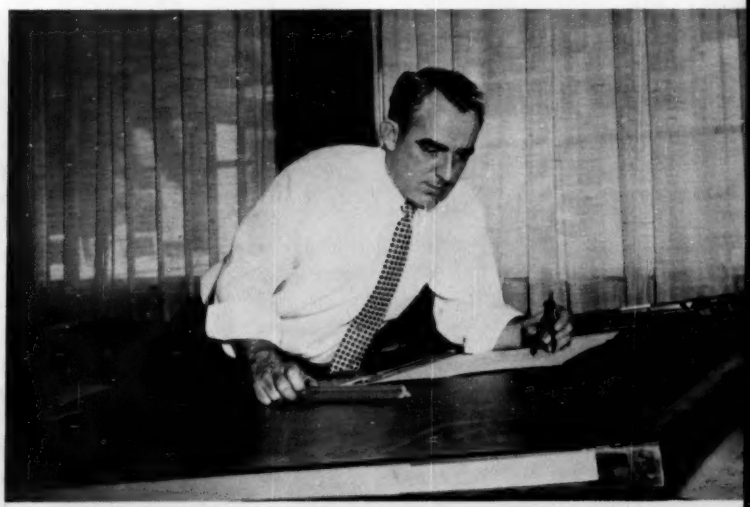
ONLY WOLVERINE?

Yes, that's right . . . because only Wolverine Tube, in the entire tubing industry, has had years and years of experience in manufacturing integrally finned condenser tube.

Wolverine's experience, for example, goes back to 1928 when it first developed Wolverine Trufin. Since then, through its own engineering research, and in conjunction with the University of Michigan, Wolverine Tube has compiled almost all the existing technical data concerning the applications and advantages of integrally finned tube.

This too, is why only Wolverine Tube is able to offer tubing users the services of its staff of Heat Transfer Specialists—highly trained men who know exactly how integrally finned tubing can help you.

Yes, only Wolverine—because of its research and years of experience—can give you truly competent finned tube guidance. For the complete story write for your copy of the Trufin Catalog.



HEAT TRANSFER SPECIALISTS

Wolverine Trufin is available in Canada through the Unifin Tube Division, London, Ontario, Canada.

CALUMET & HECLA, INC.
CALUMET DIVISION
URANIUM DIVISION
GOODMAN LUMBER DIVISION
WOLVERINE TUBE DIVISION

In Canada:
CALUMET & HECLA OF CANADA LIMITED
WOLVERINE TUBE DIVISION
CANADA VULCANIZER & EQUIPMENT CO. LTD.
UNIFIN TUBE DIVISION

WOLVERINE TUBE
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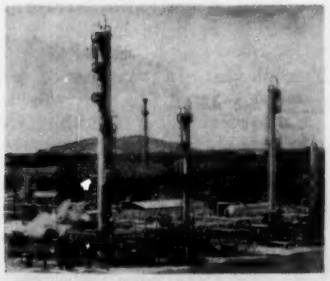
CALUMET & HECLA, INC.
17232 Southfield Road
Allen Park, Michigan
Manufacturers of Quality-Controlled Tubing and Extruded Aluminum Shapes

PLANTS IN DETROIT, MICHIGAN AND DECATUR ALABAMA.
SALES OFFICES IN PRINCIPAL CITIES

segment of the giant project is a 35,000-ton/yr. ethylene oxide plant, now being designed by Scientific Design, Inc., New York, N. Y. Esso Petroleum Co., Ltd., will pipe ethylene to the Severnside Works 70 mi. from its Fawley refinery, via a $2.2-million pipeline.

Concurrent with this development, Cyanamid of Great Britain, Ltd., plans construction of a 2,000-ton/yr. melamine plant at Gosport, Hampshire. New plant, to cost $1.2-million, is scheduled for completion by early 1961.

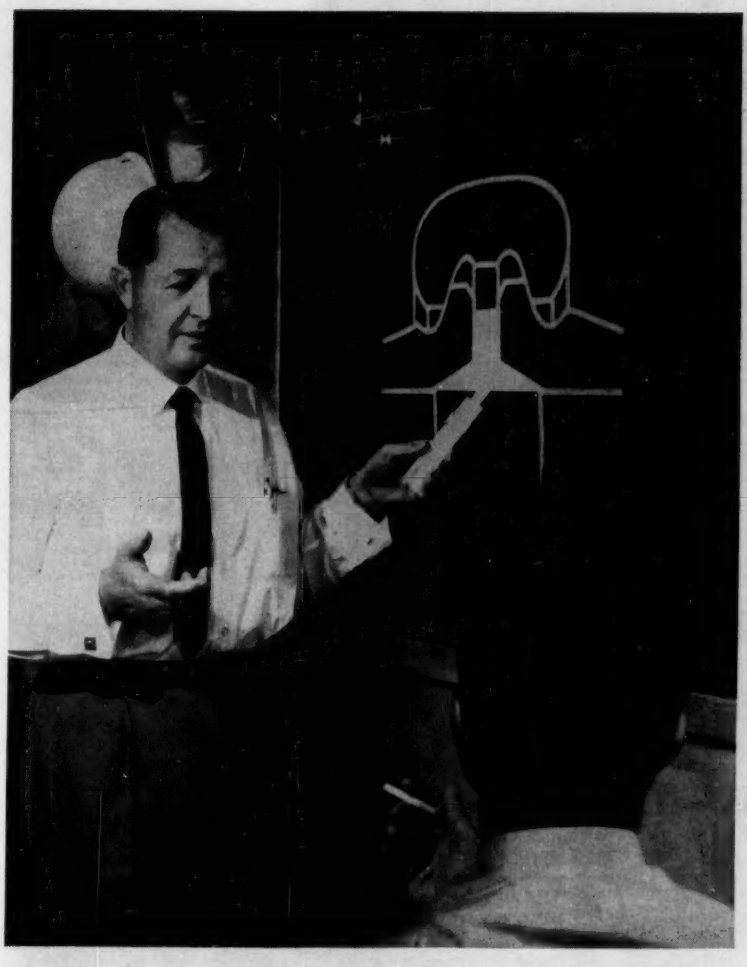


Formosa: Chinese Petroleum Corp. places on stream its new aviation-gasoline plant at Kaohsing to make its contribution to the nation's defense effort. De-isobutanizer, depropanizer, debutanizer and rerun towers complement the Texaco alkylation unit, that produces high octane gasoline components.

Australia: B. F. Goodrich Chemical Co. broke ground at Altona, near Melbourne, for a $4.5-million vinyl plastics plant; new plant will go on stream in 1961. Meanwhile, C. S. R. C.-Dow, Pty., Ltd., plans expansion of styrene monomer, ethylene dichloride and caustic-chlorine capacity at Altona, to cost $3.4-million.

England: American Cyanamid Co. plans construction of 3,000-ton/yr. melamine plant at Gosport, England, adjacent to its existing pharmaceuticals plant. Melamine output will be sold to the plastic laminates industry.

Algeria: Amidst the toil and tension of revolution, the



New GRAYLOC® Seal Eliminates Leaks

GRAYLOC is practical where leakage is a problem, regardless of high or low pressure, where savings in money, space, weight or time are desirable.

The GRAYLOC seal design, a new principle in pipe connection, is simple: tapered lips on either side of a rigid rib. The seal lip tapers slightly less than the mating hub, forming a line seal as the components touch. As the connection bolts are tightened, the lips deflect to form a positive, leak-proof surface seal. GRAYLOC Connections can be made and released repeatedly and still operate to pressure without seal ring replacement.

GRAYLOC works in most flange applications. If you are interested in more information about how GRAYLOC can solve your leakage problems and save you money, write for the new GRAYLOC CATALOG on your company letterhead. No charge, no obligation.

GRAY Tool Company

GRAYLOC SALES DIVISION

P. O. BOX 2291 HOUSTON 1, TEXAS REpublic 4-1641 04

DENVER Equipment

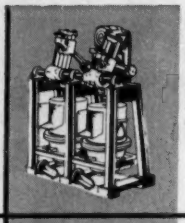
FOR THE CHEMICAL PROCESS INDUSTRY

DENVER AGITATORS AND MIXERS

Agitator types available: Turbine-type propeller (to 120" in tanks to 50' dia.), slow speed, high speed, air lift, vertical turbine mixers, mixer-settler units.

Write for Bulletin No. A2-B2

Lab and pilot scale agitators in LG3-B10

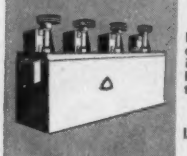


DENVER DIAPHRAGM PUMPS

Stroke can be adjusted while pump is operating. Long wearing nylon-reinforced rubber diaphragm. Sizes 1" to 10" simplex and duplex, capacity to 1000 g.p.m.

Write for Bulletin No. P6-B12

Lab and pilot scale diaphragm pumps in LG3-B10

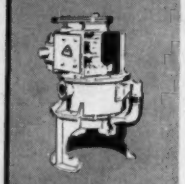


DENVER ATTRITION SCRUBBERS

High power input to efficiently remove sand coatings, mix dense slurries. Rubber lined or acid-proof tanks. Sizes to 56"x 56".

Write for Bulletin No. A-B505

Lab and pilot scale scrubbers in LG3-B10

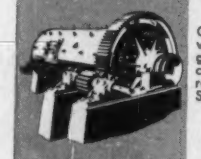


DENVER VERTICAL CENTRIFUGAL PUMPS

For handling frothy liquids or coarse, sandy slurries, constant or intermittent flow. No packing gland or sealing water. Standard or stainless steel construction. Capacity to 450 g.p.m.

Write for Bulletin No. P10-B5

Lab and pilot scale vertical centrifugal pumps in LG3-B10



DENVER BALL AND ROD MILLS

Offer operation and convertibility. Wet or dry grinding systems. All steel construction. Ceramic or rubber linings available. Sizes to 10'x 20'.

Write for Bulletin No. B2-B20

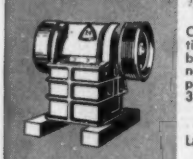
Lab and pilot scale mills in LG3-B10

DENVER SRL (RUBBER LINED) PUMPS

High efficiency, low horsepower. Parts last longer, cost less. Rubber lined. PUMPS AND PARTS IN STOCK. Sizes to 5000 g.p.m.

Write for Bulletin No. P9-B10

Lab & pilot scale SRL pumps in LG3-B10

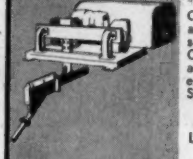


DENVER JAW CRUSHERS

Cast steel frame, anti-friction side bearings and bumper bearings. Manganese steel jaw and cheek plates. Sizes from 2¼"x 3½" to 36"x 48".

Write for Bulletin No. C12-B12

Lab and pilot scale crushers in LG3-B10

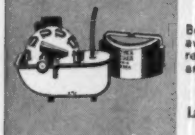


DENVER SAMPLERS

Continuous mechanical and automatic types for dry, solution or slurry sampling. Complete sampling plants and sample processing equipment. SAMPLERS IN STOCK.

Write for Bulletin No. S1-B4

Lab and pilot scale samplers in LG3-B10

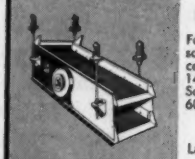


DENVER REAGENT FEEDERS

Both wet and dry feeders available. Let us know your requirements. Many standard units in stock.

Write for Bulletin No. F6-B8

Lab and pilot scale feeders in LG3-B10

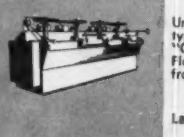


DENVER SCREENS

For efficient wet or dry screening. "True-Circle" eccentric action. Sizes to 6'x 14' in stock. Also Trommel Screens in sizes from 30"x 60"x 120".

Write for Bulletin No. S3-B15

Lab and pilot scale screens in LG3-B10



DENVER "SUB-A" FLOTATION

Universal tank with three types of mechanisms: (a) "Cell-to-Cell"; (b) "Free-Flow"; (c) Type "M". Sizes from 16"x 16" to 72"x 72".

Write for Bulletin No. F10-B36

Lab and pilot scale flotation in LG3-B10

DENVER SPIRAL RAKE THICKENERS

Move settled materials to center in one revolution. Simple, efficient, heavy-duty gear mechanism for thickeners to 150' dia. Acid proof construction available.

Write for Bulletin No. T5-B6

Lab & pilot scale thickeners in LG3-B10

DENVER EQUIPMENT COMPANY

Box 5268, Denver 17, Colorado

Phone CHerry 4-4466

SEE OUR CATALOG ON PAGES 997-1004 IN CEC.

DENVER TESTING FACILITIES

You will have problems in crushing, grinding, settling and possibly concentration and filtering. These are our specialties so please let us help you in our Test Department. Deco flowsheets are reliable and proven.

German firm, Farbwerke Hoechst, is negotiating with the French salt-mining company, Nobel-Bozel, for construction of a salt-refining plant at Arzew. Nobel-Bozel has already acquired the plant site and arranged for natural-gas supply from Hassi-Rmel.

Russia: Synthetic fibers are taking hold behind the iron curtain; McGraw-Hill World News reveals that construction has begun of an intermediate plant at Kazan, Tataria, to supply the synthetic fiber industry's feed materials. Meanwhile Russia has set up a synthetic-fibers research institute in Kiev.

Yugoslavia: In another communist sector of the world, construction has begun of a giant polyvinyl-products plant. Yugoslavia's new PV complex at Skoplje will go into full production by 1963, will produce more than $5-million worth of product annually. Concurrent with this development, construction of a 28,000-ton/yr. calcium carbide and a 33,000-ton/yr. calcium cyanamide plant is nearing completion at Jegunovci.

Austria: Featured in the new petrochemical complex at Vienna will be a 5,000-metric-ton/yr. polypropylene unit. Newly formed Danubia-Petrochemie A. G. will place on stream the first parts of the complex this fall; company co-owners, Montecatini Co. and Stickstoffwerke, will share the petrochemical profits.

Scotland: British Hydrocarbon Chemicals, Ltd. announces plans for addition of three new units to its Grangemouth, Scotland, petrochemicals plants: a butadiene unit, a new methanol unit and additional ethylene dichloride capacity. All three units are scheduled to go on stream by next year, at a cost to BHC of $14-million.

India: Hindustan Aluminum Corp., Ltd., has begun con-

struction of the 20,000-metric-ton/yr. aluminum plant midway between Calcutta and New Delhi. Plant, to be completed by 1962, will utilize 55,000 kw. of hydroelectric power, supplied from the nearby Rihand Dam. New aluminum venture is cosponsored by Kaiser Aluminum International and the House of Birlas, with a total investment of $30-million.

Japan: Electro-Chemical Co. of Tokyo announces plans to build an $80-million petrochemical plant at Goi, south of Tokyo. Maruzen Oil will supply feed for production of: chloroprene, ethylene, polyethylene, ethylene oxide, ethylene glycol, acetaldehyde, acetic acid, vinyl acetate, methanol, caustic soda, toluene, styrene and phthalic anhydride. Six-year construction program will begin next year.

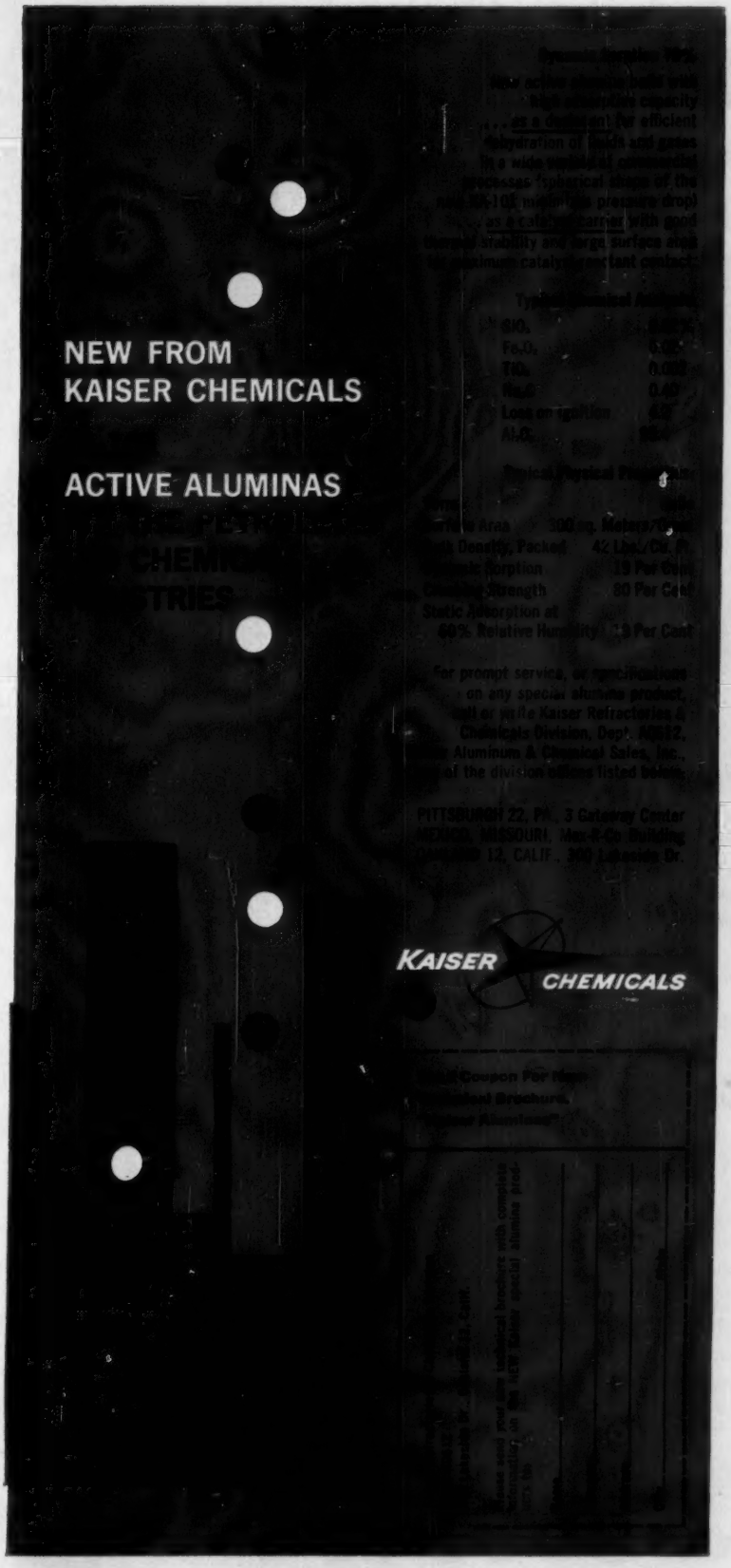
Argentina: Atanor, Compania Nacional para la Industria Quimica, S. A. M. is joining forces with Hooker Chemical Corp., Niagara Falls, N. Y., to construct a jointly owned phenol plant. Construction summer at one of Atanor's existing plant sites.

NEW LOCATIONS

Continental Carbon Co. will move its headquarters from Amarillo, Tex., to Houston, Tex., by the month of June. Company is owned by Continental Oil Co., Shamrock Oil and Gas Corp. and Witco Chemical Co.

Consolidated Electrodynamics Corp., Gmbh., is moving into new offices in Frankfurt a. M. and is establishing new headquarters in Paris, France, and Hanover, West Germany.

Swartwout Div., manufacturer of electronic process instruments is moving from Cleveland, Ohio, to Hookset, N. H. Crane Co., Chicago, Ill., recently acquired the Swartwout Division.



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LIME · RESINS · SALT · STARCH · DETERGENT POWDERS · FEEDS · PLA
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if it can be air conveyed

FLO-TRONICS®

fluidization can do it

... more economically and efficiently! Since their introduction, more and more firms using powdered or granular materials are realizing tremendous savings with Flo-Tronics Fluidization air conveyance systems. They eliminate the cost of individual containers, vastly reduce costs of hand labor, free space and working capital, and provide complete sanitation.

Typical savings (on an investment of $24,000) realized by a paper mill handling bulk starch are illustrated in this table.

	2,000,000 lbs.	3,000,000 lbs.
Volume (one type of starch)		
Annual Savings		
(a) Bulk Price Differential—$.27/cwt	$5,400	$8,100
(b) Unloading, handling & losses—$.15/cwt	3,000	4,500
TOTAL SAVINGS	$8,400	$12,600
Annual Costs		
(a) Depreciation (over 15 years)	$1,600	$1,600
(b) Taxes (1% of investment)	240	240
(c) Repairs & maintenance (4%)	960	960
(d) Operation (labor, power, etc.)	380	550
TOTAL COSTS	$3,180	$3,350
Summary		
Annual savings before Federal Inc. Taxes	$5,220	$9,250
Return before Federal Inc. Taxes	21.8%	38.5%
Net savings after Fed. Inc. Taxes (at 52%)	$2,505	$4,440
Return after Federal Inc. Taxes	10.4%	18.5%
Pay out time (after deprec. & Fed. Taxes)	9.6 yrs.	5.4 yrs.

Whether you require a complete Fluidization system or merely system components, Flo-Tronics can custom-build to your specifications or requirements. For an engineering evaluation of your material handling requirements—or simply a discussion of your needs with your own engineers, write or call Mr. William P. Edmunds, Dept. 104

FLO-TRONICS INC
1420 zarthan avenue
minneapolis 16, minn

CALENDAR

American Society of Mechanical Engineers-Institute of Radio Engineers-American Institute of Electrical Engineers, third annual conference on Automatic Techniques, Cleveland-Sheraton Hotel.
April 18-19 Cleveland, Ohio

Stanford Research Institute, Symposium: Chemical Reactions in the Lower and Higher Atmospheres, Mark Hopkins Hotel.
April 18-20 San Francisco, Calif.

American Society of Lubrication Engineers, annual meeting and exhibit, Netherland-Hilton Hotel.
April 19-21 Cincinnati, Ohio

Society of Plastics Engineers, technical conference: Plastics in the petroleum and chemical industries, Hotel Texas.
April 20 Fort Worth, Tex.

Oklahoma State University, heat-transfer conference.
April 20-22 Stillwater, Okla.

National Petroleum Assn., semi-annual meeting, Cleveland-Sheraton Hotel.
April 20-22 Cleveland, Ohio

Instrumentation for the Process Industries, symposium sponsored by Texas A. & M.
April 20-22 College Station, Tex.

German Industries Fair, Hanover Fair Grounds.
April 24-May 3 Hanover, W. Germ.

Society of the Plastics Industry, annual Canadian Section conference, London Hotel.
April 25-26 London, Ont.

American Society of Mechanical Engineers, Maintenance and Plant Engineering Conference, Chase-Park Plaza.
April 25-26 St. Louis, Mo.

American Society of Mechanical Engineers, Metals Engineering Div., AWS Conference, Biltmore Hotel.
April 25-29 Los Angeles, Calif.

American Welding Society, annual conference and exhibition, Great Western Exhibit Center.
April 25-29 Los Angeles, Calif.

Natural Gasoline Assn. of America, annual convention, Rice Hotel.
April 27-29 Houston, Tex.

Electrochemical Society, national meeting, Lasalle Hotel.
May 1-5 Chicago, Ill.

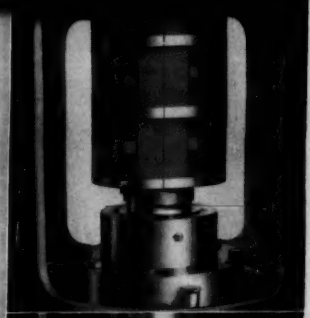
Instrument Society of America, Wilmington Section, national symposium: safety in electrical instrumentation, du Pont Country Club.
May 2-3 Wilmington, Del.

Canadian Dept. of Mines and Technical Surveys, Conference: Methods of Reducing Iron Ores, Lasalle Hotel.
May 3-5 Chicago, Ill.

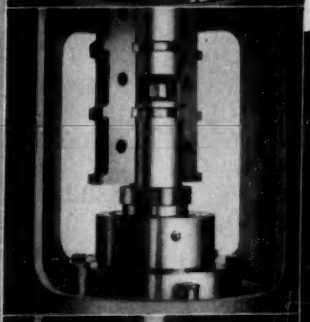
Society of Chemical Industry, Chemical Engineering Group, interna-

SIMPLY DO THIS!

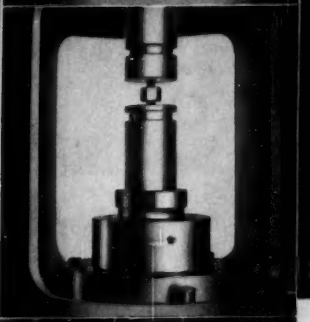
One easily assembled, self-aligning split sleeve coupling connects drive shaft and stirrer shaft.



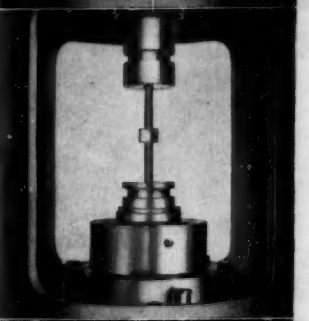
❶ Release sleeve collar set screws. Remove ½ of split sleeve coupling.



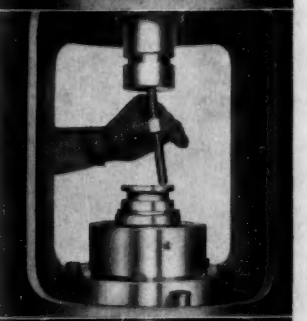
❷ Relieve shaft weight and remove remaining coupling half.



❸ Lower shaft on to support.

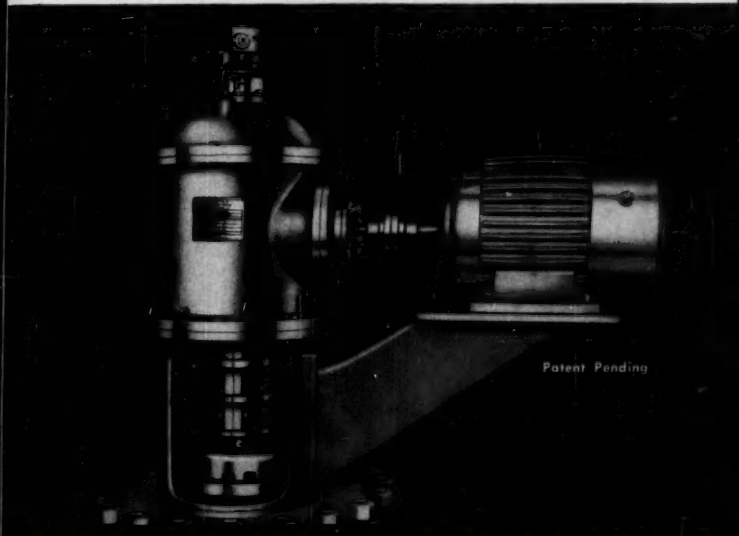


❹ Remove adjusting screw from opening.



❺ Unbolt and remove seal assembly. Reverse procedure to replace seal!

NEW! EASIEST, QUICKEST MECHANICAL SEAL CHANGE CUTS MIXER MAINTENANCE COSTS!



Improved Processing Through Engineered Agitation

A few turns of a wrench . . . and Nettco seal assemblies on tank top mixers can be changed quickly, efficiently . . . regardless of mixer size. Costly downtime eliminated! Design simplicity reduces initial cost! No special skills or equipment required!

DESIGN FEATURES

- No overhead lifting device required. Result: minimum overhead space needed . . . reduced maintenance labor and less downtime.
- Compact design with minimum distance between seals and drive bearings. Result: less shaft flexing at seals . . . reduced seal wear.
- Coupling jacks eliminated. Result: no working in cramped areas.
- No dismantling mixer . . . drive bearing untouched. Result: easier, faster seal maintenance . . . no bearing readjustment problems.

Nettco's Seal Replacement is easiest ever. For complete details, write for Bulletin 601 on your company letterhead. **Nettco Corporation, 87 Tileston St., Everett 49, Mass.**

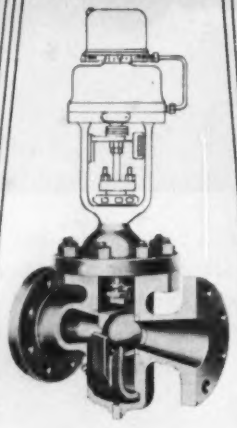
NETTCO

ENGINEERED AGITATION SPECIALISTS
EVERETT 49, MASSACHUSETTS

General Kinetics Corp.

HIGH FLOW CAPACITY...

6"
P-K PAUL VALVE
Equals
8" GLOBE VALVE
IN VOLUME OF FLOW



The high flow capacity of P-K Paul Control Valves is one of their most outstanding features. Based on a unique Venturi ball design, these valves offer **straight through non-turbulent flow.** They are self-purging and handle slurries and fluids containing suspended solids without difficulty. They are **highly resistant to erosion and wire drawing, minimize flashing and cavitation problems, and are virtually unaffected by temperature.** The ball-seat feature provides positive **shut-off, greatly increased valve life, greater stability and wide rangeability.**

Write today for technical catalogue

197 SOUTH VAN BRUNT STREET
General Kinetics Corp.
ENGLEWOOD, NEW JERSEY

CALENDAR . . .

tional symposium on distillation, The Dome.
May 4-6 Brighton, England

Instrument Society of America, Instrument-Automation Conference and Exhibit, Brooke Hall and Civic Auditorium.
May 9-12 San Francisco, Calif.

Oklahoma State University, Industrial Operations Analysis Conference.
May 9-11 Stillwater, Okla.

Southwestern Metal Congress, and Exposition, Sheraton-Dallas Hotel and State Fair Park.
May 9-13 Dallas, Tex.

National Assn. of Corrosion Engineers, workshop clinic: organic coatings on ferrous surfaces, Hotel Niagara.
May 11-13 Niagara Falls, N. Y.

Fluid Controls Institute, Spring meeting, The Greenbrier.
May 11-14 White Sulphur Springs, W. Va.

American Institute of Industrial Engineers, annual meeting, Dallas Sheraton Hotel.
May 12-14 Dallas, Tex.

Southern Methodist University, lecture series: Heat Transfer in Electronics and Direct Conversion of Heat to Electricity.
May 13-14 Dallas, Tex.

United States Army, national power sources conference.
May 17-19 Fort Monmouth, N. J.

Society for Experimental Stress Analysis, Spring meeting, Hotel Severin.
May 18-19 Indianapolis, Ind.

American Gas Assn., production meeting, Roosevelt Hotel.
May 23-24 New York, N. Y.

American Society for Quality Control, annual convention, Sheraton Hotel.
May 23-25 San Francisco, Calif.

Technical Assn. of the Pulp and Paper Industry, annual Coatings Conference, Edgewater Beach Hotel.
May 23-25 Chicago, Ill.

Design Engineering Conference and Exhibit, sponsored by American Society of Mechanical Engineers, Statler-Hilton Hotel and Coliseum.
May 23-26 New York, N. Y.

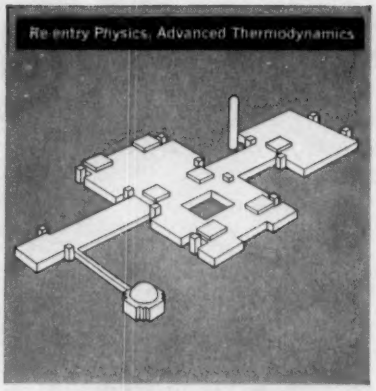
Instrument Society of America, Instrumental Analysis Symposium.
June 1-3 Montreal, Ont.

Vacuum Metallurgy Conference, New York University Engineering School.
June 2-3 New York, N. Y.

American Society of Mechanical Engineers, semi-annual meeting, Statler-Hilton Hotel.
June 5-9 Dallas, Tex.

Society of Plastics Industry, annual plastics exposition, Coliseum.
June 5-9 New York, N. Y.

National Society of Professional Engineers, annual meeting, Statler-Hilton Hotel.
June 9-11 Boston, Mass.



ADDITIONAL OPPORTUNITIES IN A NEW RE-ENTRY PHYSICS GROUP BEING FORMED BY DR. P. J. FRIEL

To carry on re-entry studies and investigations in the following areas:

- Ablation Phenomena
- Flow-field electron density
- Radiation flux prediction
- Radar cross section and signal attenuation predictions
- Non-equilibrium effects in flow-field calculations
- Materials behavior at high temperatures

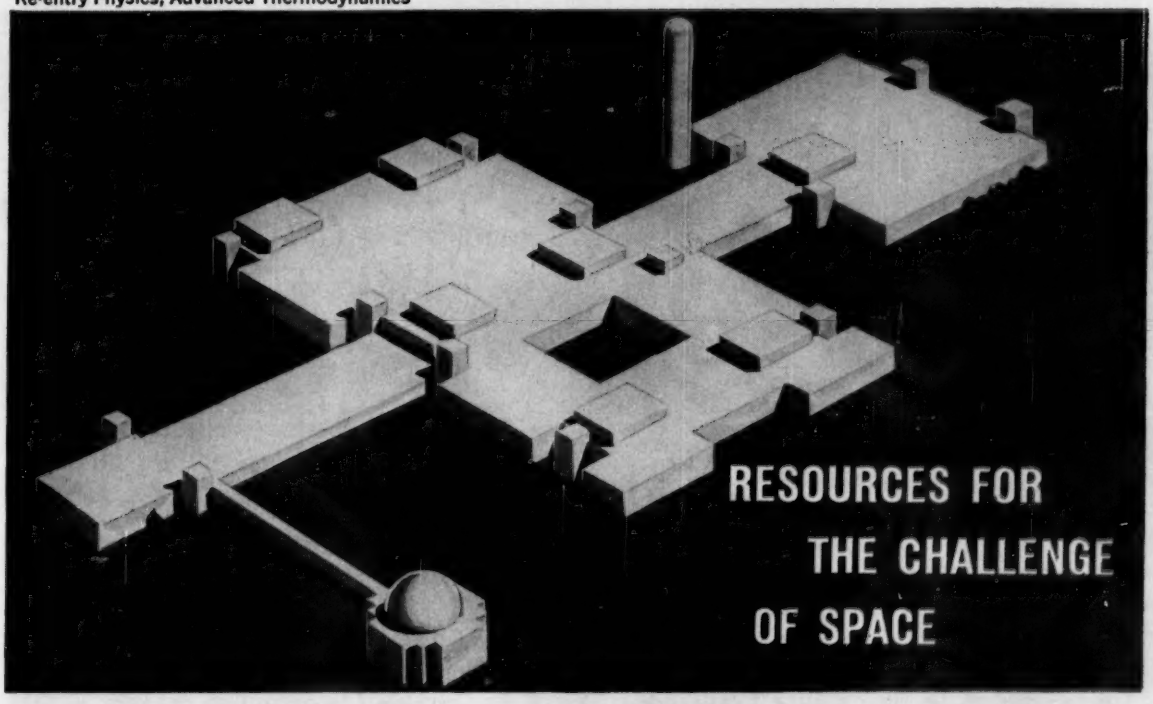
Necessary requirements include advanced degree in Physics, Chemical Engineering or Physical Chemistry, plus experience in any of the following:

- Thermodynamics
- Chemical kinetics
- Materials behavior
- High-temperature gas radiation
- Hypersonic flow
- Heat transfer
- Fluid mechanics
- Plasma propagation
- Nuclear radiation

For further information regarding opportunities here write Mr. Thomas H. Sebring,
Div. 66BWP
You will receive an answer within 10 days.

MISSILE & SPACE VEHICLE DEPT.
GENERAL ELECTRIC
3198 Chestnut Street, Philadelphia 4, Pa.

Re-entry Physics, Advanced Thermodynamics



...General Electric's New $14,000,000 Space Research Center, to be built near Valley Forge Park 17 miles from Philadelphia

The Missile and Space Vehicle Department is enlarging its activities in the field of advanced thermodynamics. New long range programs include next generation Atlas and Thor nose cones, NERV (Deep space radiation probe), Discoverer, STEER (Communications satellite) and Skybolt (Air launched ballistic nose cone).

Those who join us will work in a professional atmosphere with other highly trained and competent individuals, many of whom took part in such Department achievements as the FIRST re-entry vehicle at ICBM range with both heat sink and ablation methods. And the new *Space Research Center*—which General Electric is building in residential Valley Forge will offer unique facilities to further their investigations.

Immediate positions available:

ENGINEER-INTERNAL ENVIRONMENT

Responsibilities include thermodynamic systems design of orbiting satellite vehicles including active and passive temperature control systems.

ENGINEER-THERMODYNAMIC DESIGN

Thermodynamic design for re-entry, ballistic, and satellite vehicles using heat sink, ablation, radiation thermo protection systems for lifting and non-lifting loads.

ENGINEER-HYPERSONIC AERO/THERMODYNAMICS

Experienced in boundary layer skin friction and heat transfer phenomena, ionization effects, boundary layer interaction phenomena, mass addition systems and aerodynamic noise.

ENGINEER-MATERIALS THERMODYNAMICS

Materials heat transfer engineers experienced in heat sink, ablation, and ceramic-type materials. A knowledge of space environmental effects advantageous.

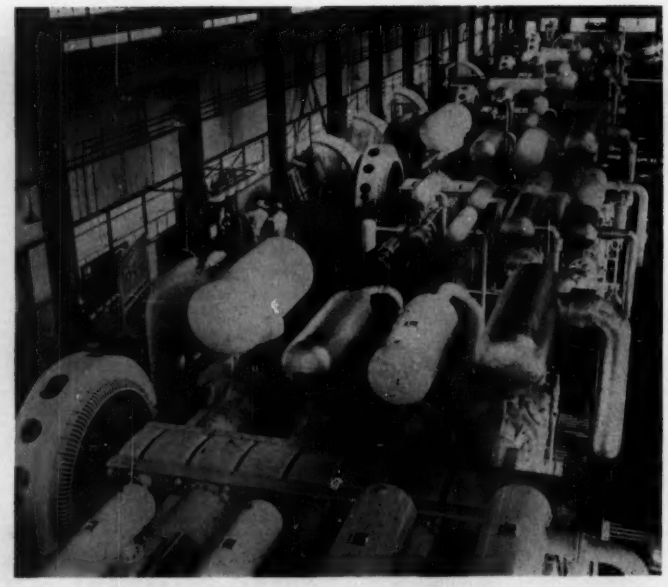
Check additional openings listed to the left:

For further information regarding opportunities here, write Mr. Thomas H. Sebring, Div. 66BWP
You will receive an answer within 10 days.

MISSILE & SPACE VEHICLE DEPARTMENT

GENERAL ELECTRIC

3198 Chestnut Street, Philadelphia 4, Pa.



Petroleum Chemicals, Inc., Installs 98 Burgess-Manning Snubbers To Prevent Pulsation Damage In New Ammonia Plant

Foster Wheeler Corporation was contracted by Petroleum Chemicals, Inc., to design and construct a multi-million dollar ammonia process plant at Lake Charles.

Realizing that gas pulsation would cause severe operating problems in the multi-service process piping related to reciprocating compressors, and that hazardous pulsation should be engineered out of the plant in the initial design, Foster Wheeler called upon Burgess-Manning Company to develop pulsation snubbers for various service conditions and for installation under the original contract.

Ninety-eight pulsation snubbers of 46 individual designs were installed on multi-stage, multi-service compressors. The snubbers were installed on both the suction and discharge sides of the compressor cylinders in what is believed to be *the largest single installation of pulsation snubbers under one roof.*

The compressors handle various types of gases, ranging in molecular weight from 5.13 to 33, at pressures from atmospheric to 9,270 P.S.I.A.; and at discharge temperatures to 350° F. Under these exacting conditions, Burgess-Manning accepted the responsibility to engineer and supply pulsation snubbers of optimum design that would: *1. Hold the pulse amplitude to 2 per cent or less, total surge peak-to-peak, of absolute line pressure, and 2. hold a minimum pressure drop requirement.*

The snubbers were subjected to the stringent specifications of material, workmanship, and inspection procedures normally followed by Foster Wheeler in process plants of this type. All forged snubbers for high-pressure service were made of high tensile alloy steel. Internal assemblies were engineered to withstand extreme forces.

After the plant went on stream, operational inspection revealed minimum pulsation-induced vibration, eliminating operating hazards, constant maintenance, and upkeep of the laterals, headers, intercoolers, and separators attendant to the snubbers.

If you are planning a new plant, or have a pulsation problem in your present plant, it will pay you to consult Burgess-Manning — "The Sound Engineering People." There's no obligation, of course.

Sound Engineering

INDUSTRIAL SILENCER DIVISION

BURGESS-MANNING COMPANY

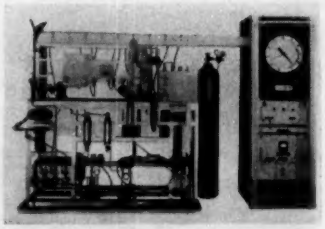
9207 SOVEREIGN ROW • DALLAS 7

Sales Engineering Representatives Coast to Coast

NEW EQUIPMENT . . .

(*Continued from page* 121.)

expected to be in metal welding and cutting applications. — **Aerojet-General Corp., Azusa, Calif.** 121D

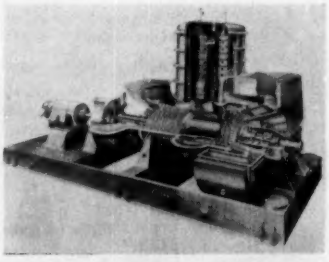


Waste-Water Analyzer

Tiny "plant" reads directly in ppm. organic carbon.

Described as a new item of technology back in 1956 (*CE*, April 1956, p. 120), a waste-water analyzer that continuously determines and records dissolved organic matter in chemical plant waste water is now available on a commercial basis. Flow scale sensitivity is 200 ppm. by weight of organic carbon; this value may be extended to about 1,000 ppm.

Concentration changes of approximately 1 ppm. organic carbon are readily detected. Provisions for automatic standardization and analysis of batch samples are included.—**Lockwood & McLorie, Inc., Hatboro, Pa.** 236A



Gas Turbine

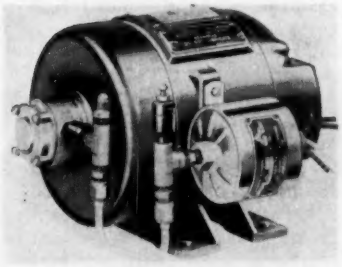
Single-shaft machine for driving process equipment.

Substantial savings in initial cost, transportation, floor space, foundation and installation ex-

pense were among the design objectives of the new Model 305-S gas turbine. This open-cycle, single-shaft machine has a NEMA rating of 9,000 bhp. Burning either liquid or gaseous fuels, the prime mover is capable of continuous operation under full-load conditions at normal rated speed of 5,000 rpm.

In applications requiring limited-speed flexibility, the 305-S provides a reliable source of rotative power for centrifugal compressors, power generators and liquid pumps. Inlet temperature is held under 1,400 F.; the turbine is completely air-cooled.

Furnished as standard equipment is a pneumatic control system that provides semiautomatic shutdown and startup, automatic control of output speed in horsepower, automatic limiting of turbine inlet temperature, and operation on 60 psi. instrument air supply.—**Clark Bros., Olean, N. Y. 236B**



Air Pump

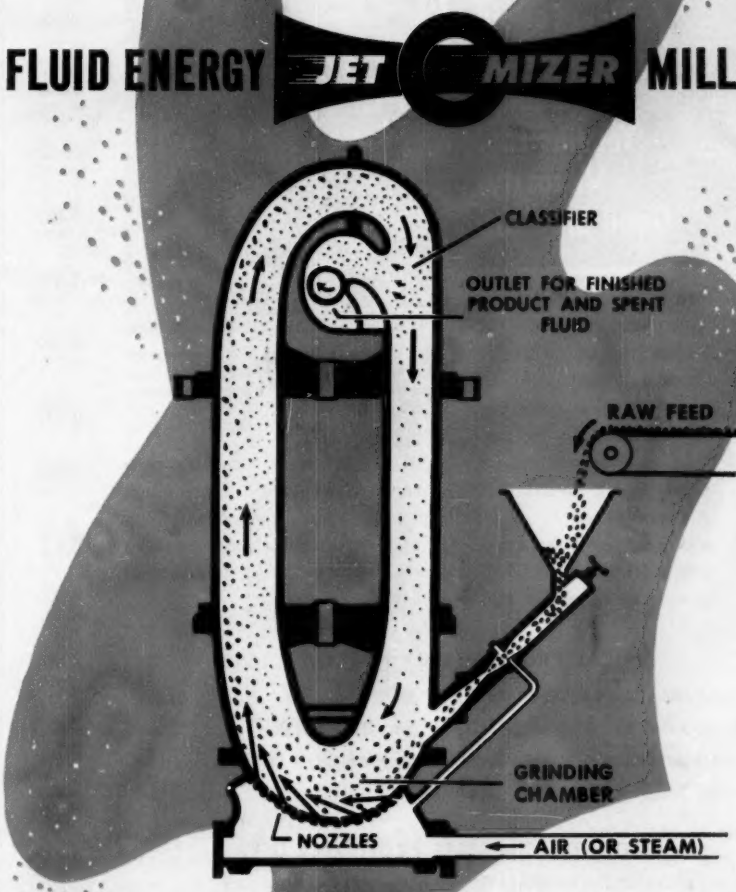
Automatically maintains pressure at 20 psig.

Prelubricated bearings, self-lubricating thrust plate and blades, and oil-free impeller parts with no seals or packings are among the features of a new air pump having a rated capacity of 0.3 cfm. at 20 psi. Called Model RG 10470, the pump has a pressure switch that provides automatic shutoff above 20 psi., and automatic re-start at pressures below 18 psi. The switch is adjustable.

A single-phase motor, developing ½ hp. at 3,450 rpm. transmits power to both pump rotor and sliding blades. An integral

for GRINDING AND DEHYDRATION
FINER PARTICLES
LOW MAINTENANCE

FLUID ENERGY JET-O-MIZER MILLS



The Fluid Energy "Jet-O-Mizer" Mill, designed and built by the pioneers in fluid energy fine grinding, does far more than produce fine particles. It controls fineness and product quality with a narrow distribution range and simultaneously with grinding can dehydrate, coat particles, blend and achieve chemical changes.

Jet-O-Mizer Mills are being used all over the world, processing many types of materials in the following industries:

- Abrasive
- Food
- Pigment
- Wax
- Insecticide
- Mineral
- Plastic
- Metal
- Ceramic
- Pharmaceutical
- Carbon
- Chemical

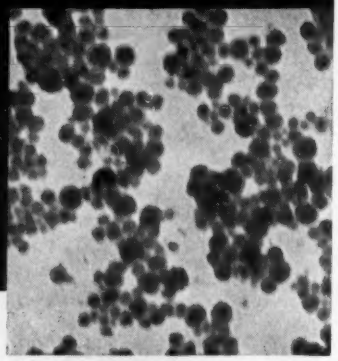
"Jet-O-Mizing" produces **FINE PARTICLES** ¼ micron average and above **PLUS** . . . Narrow Particle Distribution • Dry, or Controlled Moisture Content • Continuous Operation • Uniformity of End Product • Other Operations with Grinding • No Attritional Heat — No Moving Parts • Low Operating Costs • Low Maintenance

Send for complete information on Fluid Energy's "Jet-O-Mizer" Mills, "Jet-O-Clone" Dust Collectors, and TESTING AND CUSTOM GRINDING services.

FLUID ENERGY PROCESSING & EQUIPMENT COMPANY
Richmond & Norris Streets, Philadelphia 25, Pa. • Phone: Regent 9-7728
(Formerly known as the Wheeler-Stephanoff Mill)

Nalcoag® 1050
STABLE SILICA SOL
49-50% Silica by Weight

New Colloid Carries Heavy Silica Load, Yet has Low Viscosity, Good Stability



Silica spheres in Nalcoag exhibit a high degree of uniformity, have 20-25 millimicron diameters. *Photo taken by electron microscope in Nalco laboratories. 65,000X.*

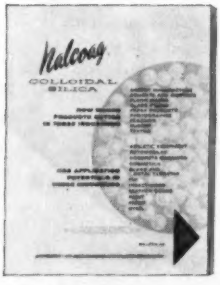
New Nalcoag 1050 is the "compact" model in the Nalco line of colloidal silicas . . . first commercial silica sol to offer you 49-50% silica by weight!

In comparison with the 20% to 35% concentrations now widely used, Nalcoag 1050 gives you up to 60% more silica in every drum . . . effects real savings in storage, handling and transportation costs. And despite its high concentration new 1050 has the high stability and low viscosity so essential to ease in handling and application.

TYPICAL PROPERTIES OF NALCOAG 1050

Percent colloidal silica as SiO_2....49-50	pH.....9.0±0.1
Average surface area, M^2/gram..120-150	Viscosity at 77°F. cps.....20-30
Average particle size, millimicrons 20-25	Specific Gravity at 68°F.....1.385
Density, lbs./gal. at 68°F.....11.6	Na_2O, percent.....0.30

BOOKLET SUGGESTS PROFITABLE USES FOR Nalcoag



And these are many! Nalco Bulletin K5 will explain the various ways in which Nalcoag can improve such products as:

Paper Containers — **Textiles**
Floor Waxes — **Foam Rubber**
Cements & Mortars — **and many others.**

Write for your copy today. And if you would like a sample of new Nalcoag 1050, be sure to tell us. We will be glad to send that, too.

NALCO CHEMICAL COMPANY
6216 West 66th Place — **Chicago 38, Illinois**

Subsidiaries in England, Italy, Mexico, Spain, Venezuela and West Germany
In Canada—Alchem Limited, Burlington, Ontario

Nalco®
. . . Serving Industry through Practical Applied Science

Nalco CHEMICALS

check valve in the output line stops loss of pressure when the pump is not operating.—**Lear, Inc., Grand Rapids, Mich. 237A**

Pipe Gaskets

Packaged with positioning cardboard templates.

Called Task-Line, a new line of pipe gasket fabricated from a Teflon resin and steel unit is available in five different flange pipe sizes—½, ¾, 1, 1½ and 2 in. (150-lb. series). Standard thickness is 1/16 in.; ⅛ in. and special thicknesses are offered on special order.

One important feature of the line is the disposable cardboard template supporting package for each gasket. The template simplifies installation, as follows: remove cellophane tape; insert gasket and cardboard template into position; place bolts through template holes and tighten; then tear out the template. — **The Duriron Co., Inc., Modern Industrial Plastics Div., Dayton, Ohio. 238A**

Densiometer

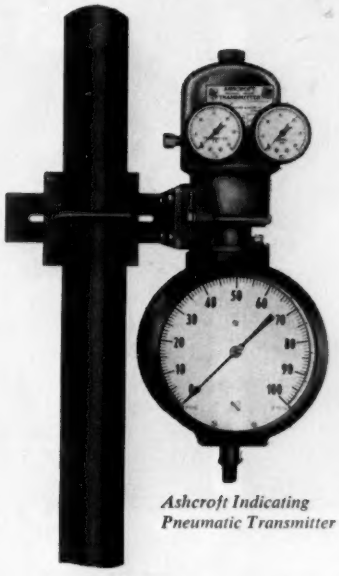
Continuously gives weight of flowing liquids.

Continuous weighing of a liquid at a continuous or varying flow rate is the function of a completely pneumatic liquid densiometer. The device will handle any liquid that can be pumped, at temperatures and pressures to 220 F. and 5 psi.

Constructed of stainless steel, the equipment employs a forced

signal

ASHCROFT PNEUMATIC TRANSMITTERS give you a true primary and transmitted signal for indication or control



Ashcroft Indicating Pneumatic Transmitter

action

Now—detect with precision accuracy the slightest change in primary pressure or temperature. Transmit this signal quickly to your indicators or controllers. Ashcroft Pneumatic Transmitters achieve these results for you at the lowest initial and operating costs.

Full-range, solid-front indicating and totally accessible nonindicating transmitters eliminate the need for costly high pressure lines, yet permit complete monitoring of process conditions in remote areas.

Narrow-span Ashcroft Transmitters are expressly designed with highest sensitivity and repeatability for the most accurate primary signal feed to controllers. You get better control and purer, lower-cost final products.

Only in Ashcroft Pneumatic Transmitters can you get the wide choice of Ashcroft Duragauge Bourdon tubes or American mercury or gas-actuated systems for sensing pressure or temperature conditions. You also get a time-proven, obstruction-proof, force-balance, nonbleed relay for economical, maintenance-free 3-15 psi or 3-27 psi signal transmission.

Write for factful Bulletins 360 and 361 or ask your nearby Ashcroft Distributor to help you select the right transmitters and receiver gauges for your specific requirements.

MAXWELL M&M MANNING & MOORE INC. TRADE MARK

ASHCROFT PNEUMATIC TRANSMITTERS

A product of

MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Stratford, Connecticut
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

UNRETOUCHED ACTION PHOTOS PROVE SUPERIOR PERFORMANCE OF BUELL CYCLONES

BUELL CYCLONE with Shave-Off

an ordinary cyclone

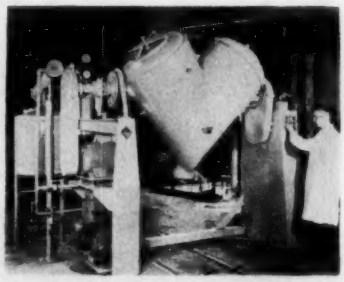
These are photographs of as true a test as can be made under laboratory conditions. Notice the difference in the dust patterns! In the Buell Cyclone, on the left, the dust at the top makes less than one revolution before it is trapped by the Shave-Off. It's then channeled down to the lower portion of the Cyclone, well below the clean gas outlet.

Why is the Buell Shave-Off so effective? Primarily because it harnesses the double-eddy current to convey the dust "fines" downward quickly, thereby promoting greatly increased efficiencies. In the ordinary cyclone, as shown on the right, these "fines" concentrate and recirculate at the top, causing erosion of the cyclone. To be collected, the fine dust must travel downward close to the clean gas outlet where much of it escapes. Buell Cyclones have made an impressive record in many years of trouble-free service. To see how their extra efficiency in the Shave-Off can pay off for you, send for our Cyclone Catalog #103. The Buell Engineering Co., Inc., 123 William Street, New York 38, New York. Northern Blower Division, 6404 Barberton Avenue, Cleveland, Ohio. (Subsidiary: Ambuco Ltd., London, England.)

buell Norblo

CYCLONES • ELECTRIC PRECIPITATORS • BAG COLLECTORS • COMBINATION SYSTEMS • FANS • CLASSIFIERS

balance scale using the "U"-tube principle. Air supply may be at any pressure between 15 and 400 psi.; air consumption is negligible. Tubes and connections are 2 in. O.D. Other sizes on order.—**Bell Corp., Odessa, Tex.** 238B



Solids Processor

Combines features of a blender and tumble dryer.

Patterson-Kelley's new packaged Solids Processor combines the operations of liquid-to-solids blending and vacuum drying. This combination minimizes materials handling for a wide variety of chemical formulations.

Drying cycle of the machine may be closely controlled through regulation of three variables: vacuum, heat and tumbling action. After drying, the finished blend or granulation discharges through a butterfly or controlled-flow valve in the unit's apex. If desired, a separately actuated agitator bar can be switched on to break up granular particles to fine powder. Charge capacities range from 1 to 50 cu. ft.—**The Patterson-Kelley Co., Inc., East Stroudsburg, Pa.** 240A

Gasket Material

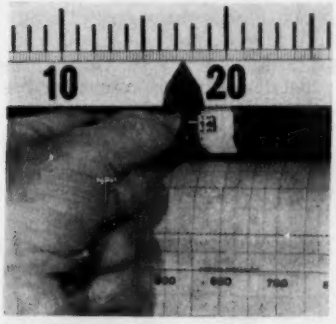
Nonmetallic product is ideal for chemical service.

Among features claimed for the new "Vistex III" gasket material are: 100% compression recovery; exceptional tensile strength; resistance to oil and aromatic fuels; good flexibility;

and nonadhesive and noncorrosive properties.

Made of fiber-reinforced nitrile rubber and Teflon resin, the material is recommended for both high- and low-temperature conditions. It comes in sheet form, up to 30 x 60 in., and in standard ¼ to ⅛ in. thicknesses. Density is 84 lb./cu. ft., and tensile strength is 1,000 psi.

Among operating characteristics found to be inherent in the new material are excellent die and hand-cutting properties; freedom from fraying and raveling; minimum-pressure sealing on either polished or irregular surfaces. Under most conditions, it can be reused.—**American Felt Co., Glenville, Conn.** 240B



Multipoint Recorder

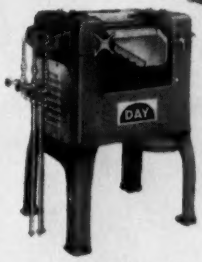
For applications requiring frequent point change.

Minneapolis-Honeywell has introduced a multipoint strip-chart recorder which, officials say, can be easily converted to change the number of points being measured, the actuation or the range. Measurements may be switched from 2 to 3, 4, 6, etc. to 24 points by simply changing the shorting plug and appropriate indicating and print wheels. Substitution of a new range card, terminal panel and scale changes actuation and range.

The Universal models come equipped with measuring circuits for potentiometers or resistance thermometers mounted on interchangeable panels, and zenor diode-regulated constant voltage units. Fixed cycle or

EVERY FEATURE YOU WANT IN A 3 ROLL MILL... YOU'LL FIND IN A

14" x 30" and 10" x 22" production models.



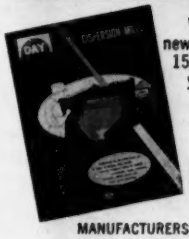
5" x 12" small production and pilot operation model.

4" x 8" laboratory mill.

DAY

Day 3-Roll Mills give you fast, consistent production at the exact fineness of grind you desire . . . are easiest to set-up, control, and to clean . . . give you years of trouble-free service at lowest maintenance costs. There's a Day Mill size to meet your batch requirements exactly — and all mills except the 5" x 12" are convertible for either fixed or float-a-roll operation.

Specify DAY HYDRAULIC ROLL SET — you'll obtain the most advanced roll setting device on the market. Available for all Day Mills except laboratory model.



Write for new Bulletin 158, or see your Day Field Engineer for full details.

The **J. H. DAY** *Co.*

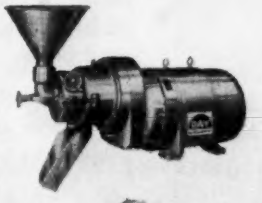
Division of The Cleveland Automatic Machine Co.

5930 Beech Street, Cincinnati 12, Ohio

MANUFACTURERS OF QUALITY MIXING, BLENDING, SIFTING, MILLING EQUIPMENT SINCE 1887

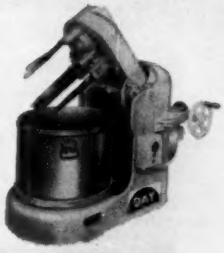
DAY HY-R-SPEED MILLS

set the pace for grinding, dispersing and blending. No skilled operator required. Complete clean-up takes less than 5 minutes. Built in three sizes: 150-300 gal. per hr.; 100-200 gal. per hr.; 10-20 gal. per hr.



DAY PONY MIXERS

assure speedy, thorough pre-mixing of vehicles and pigments. A model for every need or application — single motion and twin motion mixing action—working capacities from 3 to 125 gallons.



The J. H. DAY Co. *Division of The Cleveland Automatic Machine Co.,*

4932 BEECH STREET, CINCINNATI 12, OHIO

WHAT 7 THINGS HAPPENED RECENTLY AT FRICK COMPANY* IN WAYNESBORO, PENNA. ?

7 important things for FRICK *and you:*

1. First of all, on a foundation of our 107 years' experience, our new management has established a growth policy that stresses new product development, quality control, and expansion of field services.

2. New branch offices are being opened and the sales-engineering staffs of existing branches as well as of the home office are being increased.

3. A compressor of new design is being developed. This, like our current dependable line, will handle a variety of refrigerants such as Freon, ammonia, propane, butane and carbon dioxide.

4. A new circulating system using refrigerated sea water has been introduced to commercial fishing fleets, at a saving to boat owners.

5. Completely insulated Shell-Ice makers have been "packaged" for convenient field installation.

6. Service to the growing poultry industry has been highlighted by our new counter-flow-continuous poultry chiller, which uses refrigerated water instead of ice.

7. As part of the growth policy, we are increasing the number of Frick distributors. Some of our distributors have been with us 50 years.

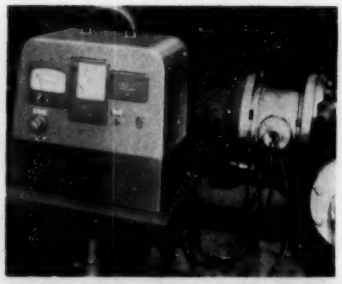
All of which indicates one thing: Frick is "on the move!" If you're passing through Waynesboro this summer, stop in and see for yourself; you'll be able to enjoy our remodeled and air conditioned offices.

FRICK COMPANY
Waynesboro, Penna.

*Pioneers in depend*ability* since 1853: air conditioning, refrigerating, ice making and quick freezing equipment, power farming machinery and portable sawmills.

NEW EQUIPMENT . . .

synchro-balance printing models are offered.—**Brown Instrument Div., Minneapolis-Honeywell Regulator Co., Phila., Pa. 241A**



Ultrasonic Flowmeter

Measures flow from outside pipe, now ready for use.

Essentially developed and ready for specific customer applications is the status of a new ultrasonic flowmeter demonstrated recently by Gulton Industries and Hersey-Sparling Meter Co. Aimed primarily at water and sewage applications, the instrument should also find wide use in the process industries.

Apparatus involves no equipment in the fluid path. Thus, there are no corrosion or erosion problems, and no loss in fluid head.

Principle of operation is notably simple. Ultrasonic vibrations are directed through a section of pipe, perpendicular to the fluid path. Stream flow causes the vibration beams to be deflected, and the amount of deflection is translated into a flow reading.

This is in contrast with most previous attempts to use ultrasound for flow measurement, which measured time required for acoustic waves to travel a known distance in the fluid.

Beams are produced and received by piezoelectric ceramic transducers mounted in a section of pipe. Fabricated in lengths corresponding to standard valve fittings, the pipe is normally intended as a permanent (non-portable) installation.

Associated electronic and indicating equipment is contained in a cabinet, which can be port-

Versatile low-cost

FEDERATED ZINC DUST

Now being used as a reducing agent, precipitating agent, purifier, catalyst, polymerizing agent, and in rust-resistant paints, bleaches, pyrotechnics, soot-removal, pipe thread compounds, and Sherardizing, zinc dust often does a better job than other compounds at less cost. Federated Zinc Dust is 97% metallic zinc, with a 97% through 325 mesh screen fineness. Send for half-pint experimental lot, and call on Federated's research and engineering assistance. Write or call: Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, N. Y. or your nearby Federated sales office.

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You can automate from bin to batch with Richardson equipment

Whether your requirements are large or small, a Richardson Select-O-Weigh automatic proportioning system offers you the advantages of – 1. Savings in labor costs. 2. Increased productivity. 3. Quality control. 4. Better housekeeping. 5. Permanent printed records. Incorporated into and governed by a Select-O-Weigh System are such units as –

Feeders – Designed to handle your material quickly and quietly – hundreds in use on all kinds of products.

Scales – Richardson Automatic Scales are known for speed and dependability. Any number can be remotely controlled by a Select-O-Weigh system.

Controls – Program your production and processes by punched card, formula board, formula capsule or weight-selector verniers. Only Richardson offers all four. Control is from a single electronic panel board, operated by one man. No special training is required.

Readout—Richardson furnishes counters, totalizers, printers, typewriters and recorders of all types.

Richardson's nationwide network of service facilities is at your disposal within 24 hours if required. Likewise, Richardson helps you at start-up of your system and thoroughly checks it in operation. For full details on how you can automate your processing with Richardson equipment, write or call today. 1791

Richardson Scales conform to U.S. Weights and Measures H-44 for your protection.

Here's the answer . . .

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MATERIALS HANDLING BY WEIGHT SINCE 1907

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Sales and Service Branches in Principal Cities • Also manufactured in Europe to U.S. Standards.

able and/or located some distance from the pipe section.

The transducers are operable over a wide temperature range. Minor variations in fluid stream temperature do not unduly affect meter accuracy, said to be 1% or better in recording totalized flow. The instrument can handle velocities of 2 to 20 ft./sec.

The meter is intended for use with liquids, as gases have a strong absorbing effect on acoustic waves of the frequency used. Cost, at least in water metering applications, is said to be of the same order of magnitude as that for conventional meters.—**Gulton Industries, Inc., Metuchen, N. J.** 242A

Starter

Combination unit has added safety features.

Consisting of a 100 Line magnetic motor starter, control transformer and branch circuit protective device, GE's new combination starter is designed to meet rigid safety requirements with no increase in price or physical size over conventional combination starters. The unit comes furnished only in a NEMA type 12 enclosure, and is offered in Sizes 1 and 2.

Meeting latest JIC and other industry requirements, design will help prevent unauthorized or careless maintenance with resultant danger to personnel,

GRASP SIZE REDUCTION PROGRESS

New criteria in chemicals and minerals grinding plants. Offer your challenge...

for fine pulverization in one pass, for simplification of grinding process, grinding without powder, control over character of particles and defibering with maximum preservation of fiber length...

for grinding heat-sensitive, oily, wet and hygroscopic substances, tough tailings, and medium-hard materials usually ground in hi-speed mills...

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TURBO

GRINDERS
PULVERIZERS
DEFIBERERS

METHODS

The Turbo-Grinder has two attrition cones standing vertically opposed with serrated surfaced. One cone revolves, bouncing feed off the cones and past a control gap between them. The rotor quickly forces feed out.

The Turbo-Pulverizer and Defiberer has two fixed cones. The rotor hurls feed against them. An adjustable air stream in a classifying action carries fine particles out an annular discharge.

Dependent on selection of wear plate design, either the jet, impact or shear principle is stressed. The machines are sturdy and simple.

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Grinding equipment is all we manufacture...

Our machines will be demonstrated from a sackfull to ten tons with your material...

Write for bulletins on TURBO-MILLS and TURBO-PULVERIZER

Polyethylene pulverized at room temperature.

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CARBOLINE'S NEW ZINC FILLED *INORGANIC* COATING FOR GALVANIC PROTECTION OF STEEL

Becomes water insoluble 20 minutes after application

Sudden rainfall, night condensation or rising tide will not wash it off or affect curing.

Carbo Zinc 11 is not only a new coating, it is a new *concept* in zinc filled inorganic coatings, with desirable properties not found in other protective coatings. In only 20 minutes the coating becomes insoluble in water. It can be applied directly to damp surfaces, in 90-100% humidity and at temperatures as low as 0°F.

Only one coat provides long-lasting galvanic protection to steel surfaces in marine, coastal and offshore environments. It is also insoluble in organic solvents, and is highly recommended for lining of solvent storage and cargo tanks. And look at its other outstanding characteristics:

- Prevents subfilm corrosion
- Excellent water, brine and solvent resistance
- Economical — low material, surface preparation and application costs
- Does not blister — cures from inside out
- No curing solution required
- Brush or spray application
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Write today for complete information, technical data, uses and sample of this remarkable new coating—Carbo Zinc 11.

**Patent applied for*

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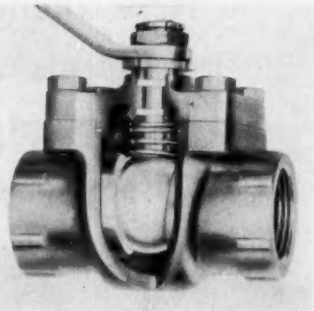
according to company engineers. For normal maintenance, the main door can be opened only with a tool when the disconnect switch or circuit breaker is in the "off" position. With the door open, the switch can only be closed by operation of a defeater mechanism.—**General Electric Co., Schenectady. 244A**



Ball Valves

Low initial cost, little required maintenance.

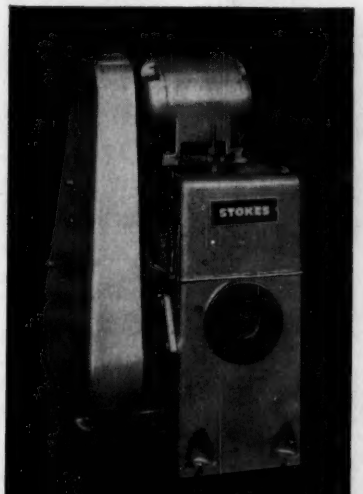
Two new models in the manufacturer's line of ball valves are both claimed to provide the full flow of a gate valve, the tight shutoff of a globe valve and the quick quarter-turn of a plug valve. One model, the McCannaseal, features two-way flow, minimum pressure drop and self-adjusting seats. The other valve, the McCannaflo, features shorter end-to-end dimensions, positive indication of valve position and a back-seating stem with double seals.

Valve design for both models permits operation at temperatures to 350 F. Maximum pressure for the McCannaseal is 700 psi.; that for the McCannaflo is 1,000 psi. Sizes range from ¼ to 6 in. in screwed-or flanged-end connections.—**Hills-McCanna Co., Chicago. 246A**

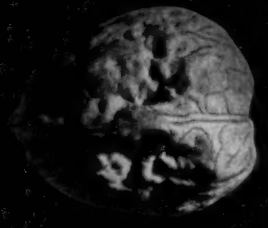
Perforated Sheet

PVC and propylene are the materials of construction.

Applications for the new line of Filter-Mesh perforated sheet include fabrication of strainers,



a vacuum pump as compact as a . . .



Yes, designed for compactness . . . and with no costly extras to buy. Saves up to 50% of your valuable floor space. But these are just a few of the revolutionary features of the new Stokes Series H Microvac pump.

Find out why Stokes offers you *more pumping performance per dollar*. Just write: Vacuum Equipment Division, F. J. STOKES CORPORATION, 5500 TABOR RD., PHILA. 20, PA.

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especially designed for small batch processes

offer . . . precise mixing results with long term cost savings

Eastern Portable Mixers are especially designed for dependable, low cost service in small batch processes. Where fixed mounted installations are not required, Eastern's Portables offer greater versatility, ease of handling, and long term cost savings.

Speeds of 420, 1125, and 1725 R.P.M. rated from 1/20 to 3 H.P. are standard, with variable speed and air-driven models also available. Motors in all standard types can be supplied in semi-enclosed, totally-enclosed, or explosion-proof construction. Shafts and single or dual propellers are available in a choice of alloys for all service requirements. New optional ball-swivel clamp as illustrated, permits easy adjustment of mixer position in tank.

For a personalized analysis of your mixing problems, send details to Eastern engineers. A recommended solution will be furnished promptly and without obligation. For a helpful guide to mixing fundamentals, write for "Handbook of Fluid Mixing."

NEW PORTABLE MIXER BULLETIN

Eastern's improved line is included in the revised Portable Bulletin No. 530-B.

Eastern

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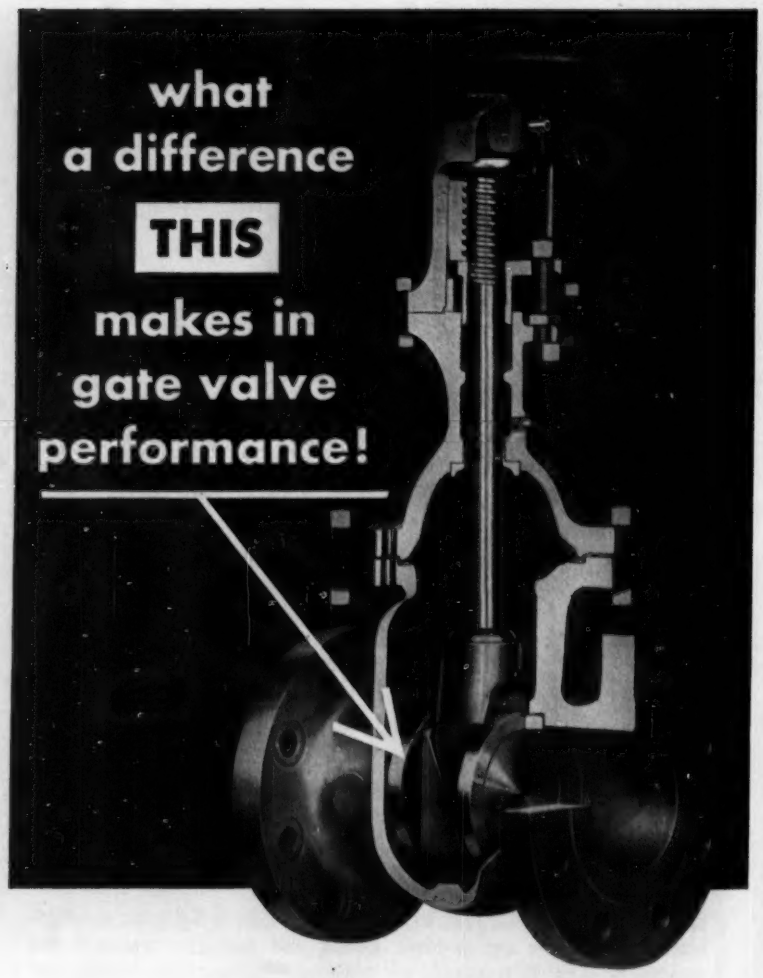
MIXER DIVISION
Regent Street
East Norwalk, Conn.



LONGER valve life, less maintenance and process interruption, positive closure, easier operation, self-adjustment for valve body deflection. These are some of the well proved advantages gained as a result of the Darling *fully revolving double disc parallel seat* principle!

These Darling valves are made in various alloys, types and sizes for most services . . . and for all pressures. Send for Catalog No. 57. You'll see what we mean by exceptional performance.

ENGINEERING SERVICE: Darling offers unusual facilities for the development and manufacture of special valves for out-of-the-ordinary requirements. This special service is available to you at all times, without obligation.

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Manufactured in Canada by
Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

filters or other cleaning devices to protect instrumentation or process equipment from damage by detrimental particles in fluid systems. One construction material, polyvinyl chloride, is ideal for contact with strong oxidizing chemicals at temperatures to 168 F.; the other material of construction, polypropylene, offers good general chemical resistance with exceptional properties in solvent service at temperatures to 250 F.

Both PVC and polypropylene Filter-Mesh sheets are available in 40- up to 5-mesh perforation sizes, and can be supplied in rolls up to 100 ft. in length. —**Dorak Products Corp., New York, N. Y.** **246B**

BRIEFS

Duo four-post selector valve, intended for use with chromatographic or other gas-analyzer circuits, comes in either aluminum or stainless-steel construction. Simple 90-deg. rotation of a single handle actuates both valve components simultaneously and permits reversal of flow direction of two fluid systems through two alternate systems. — **Circle Seal Products Co., Pasadena, Calif.** **248A**

Deburring machine for copper tubing and fittings will clean and deburr all sizes of tubing up to 4-in. Called Toled-O-Matic No. 1, the unit is portable and precision built. Use of the machine eliminates slow, costly hand work, insures tight connections, prevents leaks and reworking operations. — **The Toledo Pipe Threading Machine Co., Toledo, Ohio.** **248B**

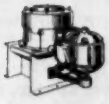
Ammonia circulation system achieves semiflooded liquid control in direct expansion coils without the use of pumps. Centralized, the system produces a constant-pressure plant feed with circulation rates to three times the evaporation rate. It is adaptable to existing plants as well as to new construction.—

The Company that cares enough to give you the best!

Laboratory Equipment

4"x 6" Massco Laboratory Jaw Crusher

Welded steel frame; manganese steel jaw and cheek plates; bronze bushed bearings; smooth jaws give better product and easier cleaning. Adjust for plate wear and product size by convenient hand wheel adjustment.

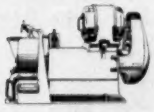


6" and 10" Massco Gy-Roll Reduction Crusher

Reduces ½" feed to as fine as 10 mesh in single pass. High capacity, low power consumption.

Laboratory Crushing Rolls

Sizes (Diameter x width): 8"x 4", 10"x 6", 10"x 8", 12"x 10" and 12" x 12". Adjustable roll space setting up to ¾". Double V-belt drive. Heavy, cast Meehanite frame absorbs vibration, results in long life.



Massco-McCool Pulverizers

Disc type grinder with a planetery movement. No gears. Will grind ¼" to 150 mesh in one pass.

Marcy Pulp Density Scale

Gives direct reading of weight; specific gravity of liquids, pulps, and dry solids; percent solids in pulp. Very accurate. Easy to clean.

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Weinman general service Unipump for top performance from 10 to 2000 GPM

Your chemical processing system is only as good as its pump. And, if you pump from 10 to 2000 GPM there's a Weinman Centrifugal Pump designed to handle the volume with low cost, 'round-the-clock precision.

Designed to handle any pumping job with speed and efficiency, Weinman's single-stage, end-suction centrifugal pumps are also available with special metals for maximum resistance to chemical corrosive action. Hand finishing of the impeller interior combined with a streamlined volute for fast, efficient pumping performance. Simple design and rugged construction affords years of trouble-free service under the toughest conditions. One piece power frame, large steel shaft and oversized ball bearings handle radial and thrust loads easily. Routine maintenance is accomplished quickly. And, in addition, Weinman manufactures a complete line of general service Unipumps for top efficiency in pumping non-caustic liquids.

For complete information on all Weinman Pumps write today. Or, check the Yellow Pages for your nearest Weinman Specialist and get expert advice right on the job.

THE **WEINMAN PUMP** MFG. CO.
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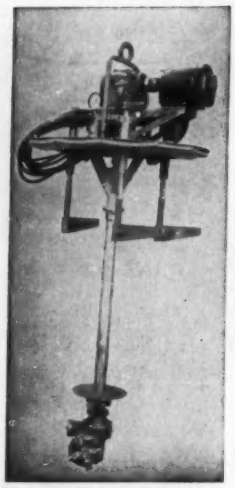
CENTRIFUGAL SPECIALISTS

This man, cleaning a tank-truck interior of alkyd resin deposits, accomplishes



Oakite Interior Tank Cleaning Unit, Model 531. Automatically sprays hot cleaning solution under pressure. Nozzles rotate vertically and horizontally. Rinses after cleaning. Sprays 45 gal/min at 150 lbs. pressure.

18 hours cleaning in 1 hour

At a New England chemical plant, it used to take three men working six hours to clean out each truck tank—two men inside the tank scrubbing, scraping and sloshing, one man astride the dome to watch in case the oxygen tanks gave out. Even at that, a careful inspection was needed to make sure the tank was properly clean.

That's how it *was*. Now, one man equipped with the Oakite 531 Interior Tank Cleaning Unit, using a cleaning solution recommended by the local Oakite representative, does the whole job in one hour flat. A sweet job, too, with the tank interior shining like new.

It's just one of the many ways Oakite methods and materials save time and money in chemical plants . . . and why you may find it well worth your while to call in your local Oakite man. Meanwhile, for details about Oakite tank cleaning equipment and Oakite cleaning methods for the chemical industry, write to Oakite Products, Inc., 16H Rector Street, New York 6, N. Y.

Technical Service Representatives in Principal Cities of U. S. and Canada

Export Division Cable Address: Oakite

OAKITE

over 50 Est. 1909 SCIENCE

years' leadership in industrial cleaning

H. A. Phillips & Co., Chicago, Ill. 248C

Controlled-temperature cabinet, redesigned to make it more adaptable to a variety of operating conditions, provides more uniform temperature, has thicker side walls, and claims a positive interlock at all seams or joints. System is designed specifically for testing mechanical specimens for tensile, compression, transverse or shear strength.— **W. C. Dillon & Co., Inc., Van Nuys, Calif.** 250A

Portable tackmeter assesses the tackiness or stickiness of a surface via measurements that are normally carried out at ten chosen points. It does not damage the surfaces under examination. Suitable for process control and laboratory. — **Testing Machines, Inc., Mineola, N. Y.** 250B

Steel conveyor belts, now available up to 4-ft. wide in carbon or stainless steel, will meet demands by food and chemical processing industries.— **Sandvik Steel, Inc., Fair Lawn, N. J.** 250C

Equipment Cost Indexes . . .

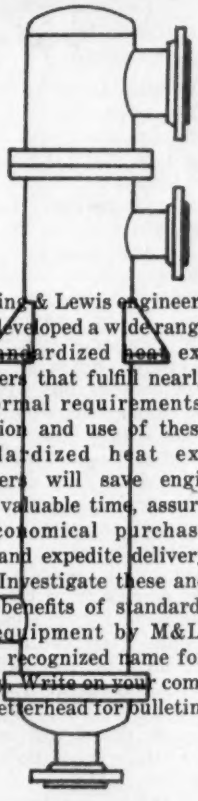
	Sept. 1959	Dec. 1959
Industry		
Avg. of all	235.8	237.0
Process Industries		
Cement mfg.	229.9	231.1
Chemical	237.5	239.0
Clay products	223.4	224.6
Glass mfg.	224.2	225.6
Paint mfg.	228.0	228.7
Paper mfg.	228.8	230.2
Petroleum ind.	232.9	233.6
Rubber ind.	235.7	236.5
Process ind. avg.	234.1	235.4
Related Industries		
Elec. power equip.	239.4	242.1
Mining, milling	239.0	240.4
Refrigerating	266.4	267.3
Steam power	223.2	223.9

Compiled quarterly by Marshall and Stevens, Inc. of Ill., Chicago for 47 different industries. See Chem. Eng., Nov. 1947, pp. 124–6 for method of obtaining index numbers; Feb. 23, 1959, pp. 149-50 for annual averages since 1913.

STANDARDIZED
HEAT EXCHANGERS
by

M&L

A MARK OF QUALITY



Manning & Lewis engineers have developed a wide range of standardized heat exchangers that fulfill nearly all normal requirements. Selection and use of these standardized heat exchangers will save engineers valuable time, assure an economical purchase price and expedite delivery time. Investigate these and other benefits of standardized equipment by M&L, long a recognized name for quality. Write on your company letterhead for bulletin.

In addition, a new four-color bulletin describes and illustrates the complete M&L line. Specify Bulletin 820 in your request.

M&L **MANNING & LEWIS**
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Dept. A, 675 Rahway Avenue
Union, New Jersey

CLEANER SANDS . . .
more efficient de-sliming
. . . with the "OVERDRAIN" Classifier

The "Overdrain" Classifier is a completely new device in the field of mechanical wet classifiers. The belt, with lifting flights attached beneath, moves upwardly out of the sand bed between two stationary side shrouds—creating the effect of a series of moving, closed, washing compartments.

The only outlet from these compartments is via holes in the belt above. Surplus liquid and slimes discharge through these "overdrain" holes without mixing with the oncoming sands. The end result is an extremely clean sand discharge, excellent de-sliming—making the "Overdrain" Classifier an ideal washing device.

Acid-Proof Construction Available

Give us details of your classifying or washing problems; Write for Hardinge Catalog 39-C-11

Section through "Overdrain" Classifier showing upward-moving, closed, washing compartments.

Unretouched photograph of "Overdrain" action above the belt—water and slimes discharging upwardly.

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Heat Exchanger
Bulletin No. 158-HE

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DEPENDABILITY

TIME AND MONEY CAN BE SAVED BY PLACING THE COMPLETE RESPONSIBILITY WITH D & R

Illustrated above is a typical D & R job . . . designed, fabricated and delivered in record time for a major chemical producer to expand existing facilities. In spite of the variety of the materials required, namely: combinations of STEEL, STAINLESS STEEL and COPPER ALLOYS, D & R's versatile standardization program enabled the customer to meet his production schedule.

Regardless of the materials required:
Steel, Stainless Steel or the Nickel Alloys,

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136-50 TWENTY-FOURTH STREET, BROOKLYN 32, N. Y.

TECHNICAL

A Treasury of Facts

ORGANIC SEQUESTERING AGENTS. By Stanley Chaberek and Arthur E. Martell. John Wiley & Sons, Inc., New York. 616 pages. $25.

Reviewed by Charles A. Kelly, Sterling-Winthrop Research Institute, Rensselaer, N. Y.

Whether the reader is a novice or an authority in the field of chelation, this book has appeal based on facts presented in a lucid manner.

Introductory parts to each of the eight chapters are such that one is intrigued to read further into the subject matter which is developed with great finesse and care. Every chapter is abundantly supplied with formulas, diagrams, figures, tables, and even photographs which clarify and emphasize the points stressed in the text.

Extensive bibliographies at the end of each chapter (over 400 references in the commercial applications chapter alone) demonstrate the surge of interest in chelates in the past ten years. The myriad of industrial uses as well as biological applications of chelates (last two chapters) are not only of interest in themselves, but also for their thought-provoking ideas which should and no doubt will lead to new and different applications of chelates.

A unique chapter in this book deals with metal buffers where the free metal ion concentration in solution is controlled within a given range—analogous to hydrogen ion buffers. The logical approach and explanations of the factors that affect the free metal ion concentration in a given system is excellent.

With such a treasury of facts dealing with the theory, chemistry and application and use of metal chelates available, one will receive values greater than the initial cost involved in obtaining this book.

BOOKSHELF

Commendation

INTRODUCTION TO CHEMICAL ENGINEERING THERMODYNAMICS. (Second edition.) By J. M. Smith and H. C. Van Ness. McGraw-Hill Book Co., New York. 490 pages. $8.75.

Reviewed by James J. Conti, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.

The authors are to be commended for again providing a treatise on chemical engineering thermodynamics in workable textbook form. The clear, concise presentation of the fundamentals coupled with illustrative problems make for a useful text for an undergraduate course.

The first and second laws of thermodynamics, and the consequences thereof, are developed clearly and rigorously. Simplifications accruing to various assumptions, e.g., the ideal gas law, are introduced for elucidation of the principles involved. The preferred use of pressure-volume-temperature data of a system for the thermodynamic analysis of a process is emphasized, while the use of estimated or predicted properties is presented as an alternative in the absence of data or correlations.

The practical implications of thermodynamics are also explored well for an undergraduate text. While one may have preferred a slightly different overall organization of the material, this is largely a question of personal preference.

MORE NEW BOOKS

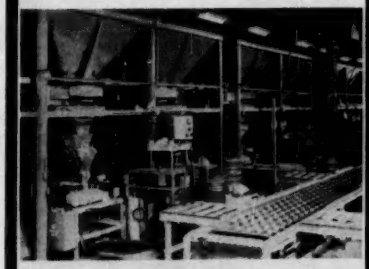
PROGRESS IN DIELECTRICS, Vol. 1. Edited by J. B. Birks and J. H. Schulman. Wiley. $11.

TEXTILE ENGINEERING PROCESSES. Edited by A. H. Nissan. Textile Book Publishers, Interscience. $9.25.

RADIATION COUNTERS AND DETECTORS. By C. C. H. Washtell. Philosophical Library. $7.50.

PROBLEM:

MAINTAIN UNIFORM GRAIN SIZE IN PRODUCTION OF RESIN-BONDED ABRASIVE WHEELS



SOLUTION:

SPROUT-WALDRON GYRO-PEDESTAL® SIFTERS

The pressure sensitive nature of the resin bonded granules used to make quality abrasive wheels at Carborundum, led to the formation of oversized agglomerates. These had to be screened out or broken up in order to maintain uniform grain size.

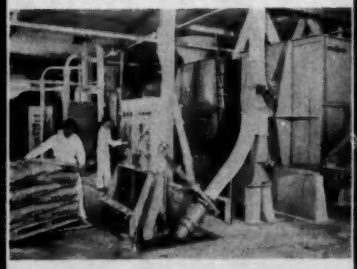
The problem was compounded by the fact that the resin bonded mixture had to be kept in surge bins at the 86 molding stations.

The use of 43 Sprout-Waldron Gyro Pedestal sifters, installed so that each sifter could serve two surge hoppers, solved the problem. The high speed gyratory action of these sifters breaks up the agglomerates and discharges a stream of uniform, correctly sized free flowing granules into the mold.

For more data on the Gyro Pedestal sifter ask for Bulletin 139.

PROBLEM:

TO BOOST STARCH AND GUM PRODUCTION WHILE CUTTING OPERATING COSTS



SOLUTION:

SPROUT-WALDRON UNIT MACHINES AND SYSTEMS

When Morningstar Paisley executives decided to move activities to their new plant at Hawthorne, N. J., they demanded a system meeting these specifications: extreme versatility, no dust nuisance, protection against contamination, low handling and operating costs, stepped up capacity.

The answer was found in a packaged processing system involving Sprout-Waldron machinery for crushing, mixing, grinding and sifting; plus a series of four negative pressure pneumatic conveying systems.

Blending and bagging of starch, gum grinding and gum granulation are now being accomplished with a minimum of handling and maximum of efficiency. Operating costs are down, capacity up. For the full story ask for Bulletin F-19.

SW SINCE 1866

SPROUT, WALDRON & CO., INC.

MUNCY, PENNSYLVANIA

Size Reduction • Size Classification • Mixing and Blending
Bulk Materials Handling • Pelleting and Densifying

COP/105

PUMP PROBLEMS
write
TABER

BEFORE DECIDING ON TYPE OF PUMPS . . .

SEE TABER BULLETINS

May avoid costly pump misapplication.

Vertical pump illustrated, for handling chemicals, please request Bulletin V-837. Horizontal Pump, Bulletin C-355.

FIG. 19,488

TABER PUMP CO.
Est. 1859
251 ELM ST.
BUFFALO 3, N. Y.

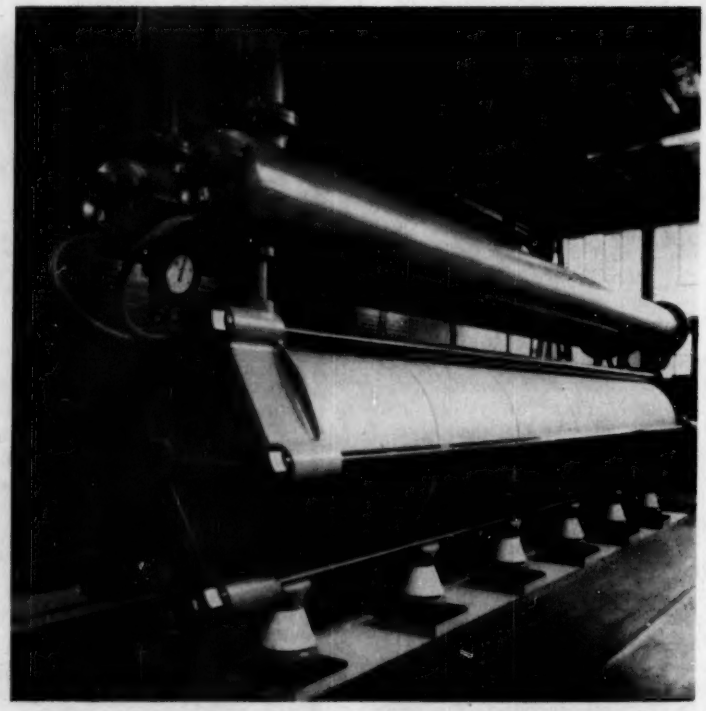
FIG. 6061

TABER

PEOPLE . . .

LETTERS: PRO & CON

C. H. CHILTON



ZDANSKY CELL: "Needs employment under a wider range of conditions."

Re: Pressure Electrolysis

Sir:

One would think at first reading your article, "Pressure Lowers Electrolytic H_2 Cost" (Mar. 7, pp. 66-68), that this was a new subject.

In the first edition (1931) of "Industrial Electrochemistry," the writer discussed the pressure hydrogen-oxygen cells which were used by the German state railways shortly after World War I. In addition, the Zdansky cell and its construction are discussed in the recently published fourth edition of this book.

While there is no question that pressure electrolysis of water has a definite place, large-scale investigations in the past by large hydrogen producers and consumers in localities where electrolytic hydrogen was economic found that pressure electrolysis is neither a panacea nor the answer to improved, lower-cost operation. They have in many cases found that the financial aspect is much more complicated than stated in your article and have shied away from pressure electrolysis.

There is no question that the Zdansky design has moved the entire art forward, but it needs employment under a wider range of conditions to determine whether it warrants investment in plant with a minimum of operator and maintenance labor.

C. L. MANTELL
Consulting Chemical Engineer
New York, N. Y.

Con: Nuclear Testing

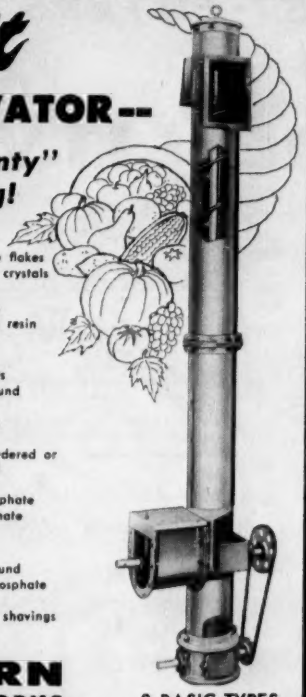
Sir:

At the time of the first Pugwash Conference of nuclear scientists, the U. S., Russia and U. K. were the sole possessors of the dread secret of the bomb.

Over a four-year period, five Pugwash scientific conferences

THE *Rotor Lift* SCREW ELEVATOR--

Industry's "Horn of Plenty" In Materials Handling!



PARTIAL LIST OF MATERIALS ELEVATED:

Alum, lump
Aluminate jell
Aluminum hydrate
Aluminum silicate
Ammonium chloride, crystalline
Ammonium nitrate
Ammonium sulphate
Antimony powder
Arsenic, pulverized
Ashes, coal
Asphalt, crushed
Bakelite, powdered
Barites
Bentonite
Bicarbonate of soda
Boneblack-bonechar
Borate of lime
Borax; powdered
Boric acid, powdered
Calcium arsenate
Calcium carbonate, pulverized,
Carbon, activated
Carbon black
Casein
Cement
Charcoal
Clays, various
Coal, bituminous
Copperas
Cork, granulated
Dicalcium phosphate
Ebonite, crushed
Feathers, steam cooked
Ferrous sulphate
Grains, distillery spent
Graphite
Gypsum
Insecticide dust
Lignite, air dried
Lime
Lime hydrate
Limestone
Lithopone
Magnesium chloride
Mica
Naphthalene flakes
Oxalic acid crystals
Paper pulp
Polyethylene
Polyethylene resin pellets
Resin
Rosin, pellets
Rubber, ground
Saltpeter
Salts, epsom
Sawdust
Shellac, powdered or granulated
Soda ash
Sodium phosphate
Sodium sulphate
Sulphur
Talc
Tanbark, ground
Trisodium phosphate
White lead
Wood chips, shavings
Wood flour

SOUTHWESTERN SUPPLY AND MACHINE WORKS

OKLAHOMA CITY, OKLAHOMA

8 BASIC TYPES
4 DIAMETERS

WORLD'S LARGEST MANUFACTURER OF VERTICAL HELICOID SCREW ELEVATORS

ROLOCK®

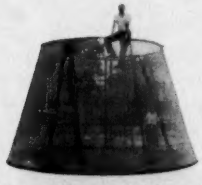
SPECIALIZED WELDED HEAT AND CORROSION RESISTANT **FABRICATIONS**

ROLOCK® can expedite solution of special process equipment problems

Rolock combines *specialized* welded-fabrication and machining skills with an experienced and fully staffed engineering department for assistance in design, as well as production and test supervision.

Rolock people are experts in work with high temperature and corrosion-resistant alloys, including Inconel, Incoloy, the Hastelloys, Monel and Stainless Steels. The Rolock plant, capable of handling fabrications of large size and scope, is equipped with manual and automatic welding equipment of advanced type, with personnel qualified for standard, special or specified code welding requirements. We are also equipped to inspect and test to customers' specifications. Write outlining your needs.

Clad work



A large alloy mesh fabrication

Alloy special duct work

A heavy alloy baffle

ROLOCK, INC. • 1340 KINGS HIGHWAY • FAIRFIELD, CONN.

2RL60

Will this $30,000 AUTOMATIC PALLETIZER save you money?

The Miller Palletizer automatically positions bags in proper pattern on the roller table. A completed pattern then moves across the rollers to an elevator, which descends one position as each layer is added. At full load position, the stack and pallet move automatically from the elevator for pick-up by a fork truck.

IF your plant is operating around the clock (7 days per week, 24 hours per day), and —

IF bag stacking is a part of that operation —

the **MILLER AUTOMATIC PALLETIZER** *is almost certain to save you money.* This completely automatic, operatorless unit is specifically engineered to slash production costs in two- and three-shift plants.

Just compare the cost of your present stacking operation with that of a Miller Automatic Palletizer (price: around $30,000).

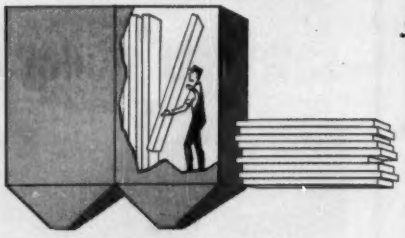
While you're thinking about it, write for bulletin describing operation of the Miller Automatic Palletizer in detail!

MILLER ENGINEERING CORPORATION

119-A EAST BARBEE AVENUE
LOUISVILLE, KY.

SINCE 1870 SLY

SLY DUST FILTERS For ACCESSIBILITY

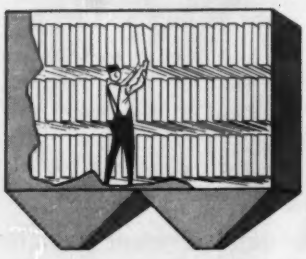


1900's
SLY DUST ARRESTER

Every cloth screen from the end of the arrester had to be removed to reach the faulty screen.

1930's
SLY TUBE-TYPE FILTER

To replace a tube required at least partial disassembly of every other tube in the way.



TODAY
NEW SLY
"ROLL-CLEAN"
DYNACLONE®

Any filter bag is easily accessible and can be replaced without need for removing others.

NEW SLY DYNACLONE PROVIDES FASTEST, EASIEST BAG CHANGING

Whether you change one bag, or the entire filter, you do it in less time with the Dynaclone. Quick replacement of individual bags eliminates the need for costly rebagging should only a few be worn. Complete change is also fastest . . . the Dynaclone has only one half as many bags as other filters with the same cloth area. In addition . . .

New "Resist-O-Wear" bags offer 200 to 300% more bag life.

The Dynaclone operates continuously. It provides complete dust suppression through constant suction.

The Dynaclone is automatically self-cleaning by reverse air. A single exhaust fan provides *both* suction for dust collection and air for bag cleaning. No auxiliary blowers required.

And the Dynaclone provides 20 to 40% more cloth in a given space than other makes of dust filters.

The Dynaclone has been proved in more than 1,000 installations. Investigate its advantages on your applications . . .

SEND FOR 36-PAGE CATALOG 104

THE W. W. SLY MANUFACTURING CO.

4771 Train Avenue • Cleveland 1, Ohio • Offices in Principal Cities • Overseas Licensee: Andrew Air Conditioning Ltd., London S. W. 1, England

PRO & CON . . .

have brought together 112 eminent specialists from 23 major nations, East and West—all of the unanimous opinion that weapons of mass annihilation must be universally banned and that delay can only lead to the eventual possession of the worst forms of weaponry by every country of consequence around the globe.

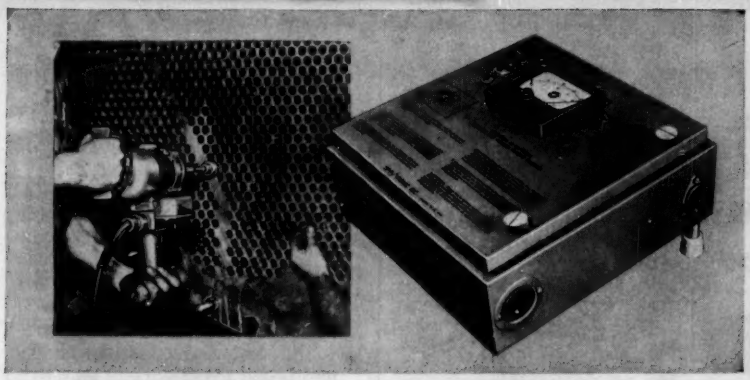
With the recent French explosion in the Sahara, membership in the nuclear club has increased to four. Unless international agreement is reached soon to prohibit tests and ban nuclear weapons, each of the other 19 nations on the Pugwash list, along with others, will in all likelihood be equipping itself with nuclear weapons. All these countries now have the requisite scientific manpower and industrial capacity.

These grave considerations dictate the urgency for early conclusion of a clear-cut test ban agreement at Geneva, where negotiations have been dragging along for more than fifteen months.

There can be no hope whatever of agreement at Geneva as long as pressure for further testing, however limited, continues to be successfully exerted on the White House and the Congress by the Defense Department, the Atomic Energy Commission and the small handful of official scientific advisers with vested interests in urging the U. S. to run the risk of further atomic tests.

Our closest Western allies have with great forbearance restrained themselves from open criticism of the U. S. position. But now they seem determined to convince the world that they, for their part, favor a different course. The Canadian government has announced a straightforward new foreign policy calling for the end of all nuclear testing and the complete prohibition of nuclear, biological and chemical warfare. At the same time, Great Britain is giving every evidence of intending to follow the Canadian example promptly.

The rivalries that now seem to loom large between the U. S. and Russia will be overshadowed by the terrible hazards that will confront mankind if 23 or more na-



Your Motor + Wiedeke Torque Control = Increased Tube Rolling Production

Save the cost of a new motor! New Torque Control Instrument for rolling ¼" through 4½" tubes in boilers, condensers and similar heat transfer vessels—operates with any Universal Reversible Electric Tube Rolling Tapper or Motor. Adjustable time cycle matches operator's dexterity.

WRITE TODAY FOR DETAILS AND BULLETIN AC-7A

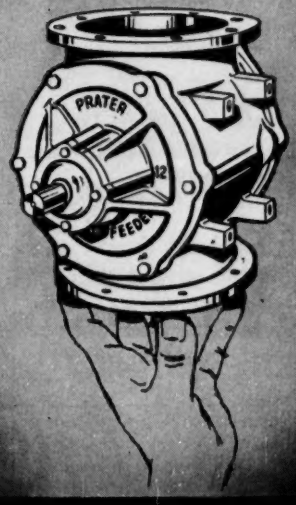
The Gustav WIEDEKE Company

DAYTON 1, OHIO

PRATER — *the recognized leader*

ROTARY AIRLOCK FEEDERS

for DUST CONTROL and PNEUMATIC CONVEYING



WRITE FOR BULLETIN P58

PRATER PULVERIZER COMPANY

1517 South 55th Court • Chicago 50, Illinois

NEW SUPER SERIES COWLES DISSOLVERS PROVIDE PLENTY OF POWER, EVEN AT LOW SPEEDS.

Now equipped with the exclusive new M P D* (Maximum Power Delivery) transmission system, these new models offer important profit advantages not available in any other mixer.

1. **Ability to deliver over 90% motor horsepower to the impeller at practically any speed.**
2. **Easy changes of speed during processing operations.**
3. **Important savings in first cost and power consumption through use of proper size motor.**

The overall results include great versatility in processing products with viscosities up to 50,000 centipoises or more, and spectacular production rates in minimum space. Here are just a few typical examples:

FLEXOGRAPHIC INK PROCESSING VERY SUCCESSFUL

Several well-known companies now produce top quality using the Cowles alone. Volume is substantially greater, in much less space with consequent savings in time and labor costs.

MOREHOUSE MILL-COWLES DISSOLVER TEAM "GANGS UP" ON LIQUID FERTILIZER PROBLEM

Mill reduces particle size of constituents that do not actually dissolve to the size that makes for good suspension in a fraction of time required by other mills. After this vitally important operation, the Cowles Dissolver is used to put together the whole formula. Rapid production of high quality liquid fertilizer results.

AGGLOMERATES IN CERAMIC MATERIALS REMOVED AND SEPARATED IN TEN MINUTES

Cowles with patented impeller used by leading company to reduce 50% to 60% suspensions of lump ball clays to 325 mesh size with amazing speed. "Books" and "Stacks" are eliminated—plasticity control greatly improved.

VINYL SOLUTIONS IN ½ THE TIME

A special, patented Cowles Impeller is reducing per-batch time to only 2 hours. Previous methods required 4 hours. For many materials the Cowles can multiply volume up to 2½ times.

IN-PLACE RUG BACKING IN BIG VOLUME

Amazing results in production of the revolutionary new foamed in-place rug padding compounds are reported for the Cowles. In a single operation, many dry materials are dispersed to ultimate particle size, let down to finished rug backing and pumped directly to tank trucks for delivery to rug manufacturers. With the Cowles, one plant is now set for 200,000 gallons per month!

Let us prove the advantages of Cowles Dissolvers in your plant—at our risk!

Write us today about problem.

MOREHOUSE-COWLES, INC.

1150 San Fernando Road
Los Angeles 65, Calif.

Representatives in Principal Cities
Convenient Lease and Time-Payment Plans

Please send me information on use of Cowles Dissolvers in processing (product) .....

.....

Name ..... **Title**.....

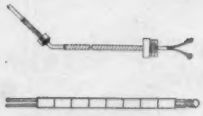
Firm .....

Address .....

City..... **Zone**..... **State**.....

* Trademark of Cowles Dissolver Company 606

If you use
THERMOCOUPLES
call for
WEST



For *all* applications—for use with all standard types of temperature indicators, controllers, recorders—we make a complete selection of thermocouples from matched and checked wires, assuring constant millivolt output for accurate readings.

See us at the
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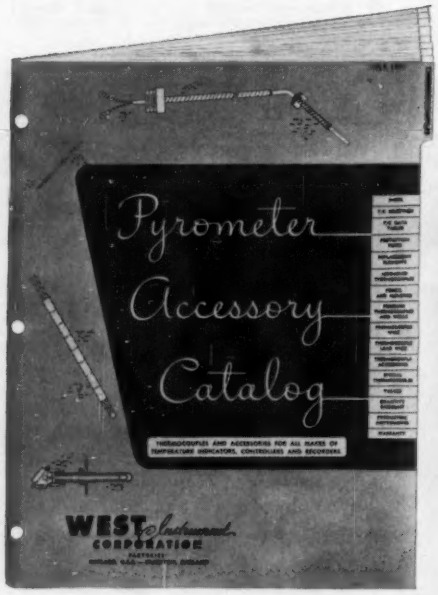
Conference & Exhibit
San Francisco, Cal.
Brooks Hall
May 10-12, 1960
Booth 419-421



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Revised 40-page file-size catalog

- Lists all data (I.S.A. standards), components and prices
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Write for your new Thermocouple Data Book now

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52 Regent St., Brighton 1, Sussex
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the trend is to WEST

tions become manufacturers of their own nuclear arms.

The eyes of the world are focused on the President of the United States—the one man who can make the fateful decision. Let us hope that his concern for humanity and respect for world sentiment, coupled with his profound knowledge of weaponry and broad experience in warfare, will tip the scales toward the immediate end of nuclear testing as the first step in disarmament.

CYRUS EATON
Chesapeake & Ohio Railway Co.
Cleveland, Ohio

Pro: Computer Guarantee

Sir:

I have read your *Chementator* item, "Computer control: Who's kidding?" (Feb. 8, p. 55), and assume you mean that Daystrom is kidding the readers of *Chemical Engineering* as well as our potential customers when you say: "As for Daystrom's statement, the computer at Sterlington was announced to be in operation in the spring of 1958—a full 19 months prior to the completed six-month guarantee period."

You are perhaps implying that Daystrom could not get ready, had too much trouble or was unsuccessful on several attempts to complete a six-months' run. To answer this allegation, I quote from our written guarantee: "Upon notification of readiness by the customer, this guarantee will be demonstrated in a continuous period for six months."

So it was at Sterlington. When they notified us of their readiness for our demonstration, we successfully ran for six months. There has been no secrecy as to the installation problems.

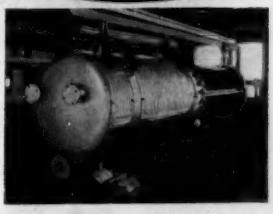
Sterlington was the first example of a solid-state digital computer installed in a power plant. We will be announcing shortly that this plant is in process control. (Until now it has been used only to data-log and to alarm-scan.) Louisiana Power & Light has ordered another control system for another station.

CHALMER E. JONES
Daystrom, Inc.
La Jolla, Calif.

HEATING HORIZONTAL FILTER PRESS

with superior

DEAN PANELCOIL



Here's another example of the versatility of Dean Panelcoil in heating chemical processing equipment. It does the job more economically and efficiently than old style pipe coil or conventional jacketing. It takes less room, weighs less, is more attractive and gives fast, even heating. Dean Panelcoil can be formed to fit any shape or size of equipment.

For complete engineering and cost data, write for new Technical Data Sheet 15-60 Series and Price Bulletin 259.

DEAN PRODUCTS, INC.
1039 Dean St., Brooklyn 38, N. Y.
STerling 9-5400

Backed by 25 Years of Panel Coil Manufacturing

NEW STRAHMAN SAMPLING VALVE CANNOT CLOG

1. In closed position stainless steel piston fills whole interior of valve — extends to inner surface of vessel — therefore foreign material cannot gather in body.

2. In open position piston retracts, leaving entire body empty for FREE-FLOWING LIVE SAMPLE.

Perfect sealing is assured by two compressible, replaceable Teflon rings.

These Sampling Valves are designed for simple installation in existing systems, merely by welding a ¾" half coupling into the pipe or vessel, from which samples are required.

PB-704

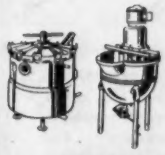
STRAHMAN VALVES, INC.
Nicolet Ave., Florham Park, N. J.

GROEN

STEAM JACKETED KETTLES

meet every processing and mixing need!

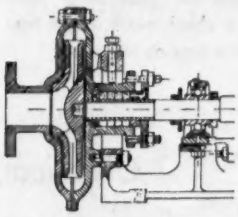
The contrast between kinds of products, where a cook-mix process is employed, staggers the imagination. We frankly don't know how many industries require this type of processing. But if you have a need for minutely controlled temperatures for either heating or cooling combined with thorough mixing or agitating, Groen steam jacketed kettles provide the most efficient method ever developed. Groen engineering research brings you unexcelled heat transfer faster, easier, with substantial savings in time and labor. Groen stainless steel processing vessels are easier-to-clean, too, providing the ultimate in sanitation. There's a size and type for every process or product. Write for complete engineering data and specification sheets.

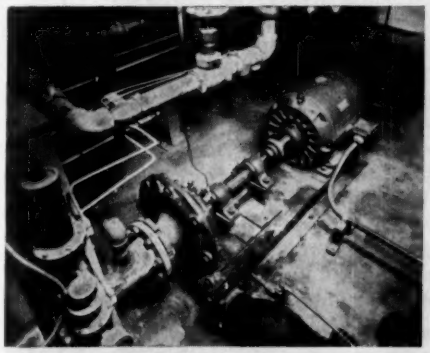


Complete line includes tanks, coils, vacuum kettles, revolving pans, tubular heat exchangers, pilot plant units and special specification equipment.

GROEN MFG. CO.
1900 Pratt Blvd., Elk Grove Village, Ill.
30 Church St., New York 7, N.Y.

BARGAIN HANDLING OF CORROSIVES





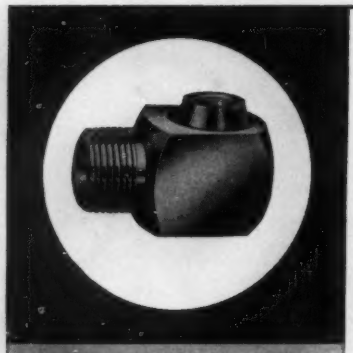
with NAGLE "KC" PUMP

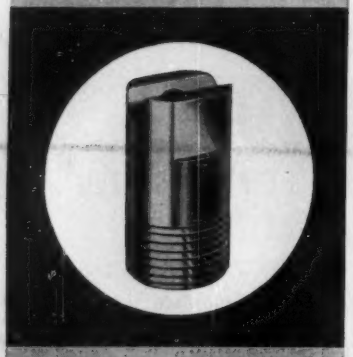
The Nagle type "KC" pump is designed to live with corrosive liquids. Impeller and casing are available in metal or alloy best suited to resist the ravages of the particular corrosive being handled. Patented arbor bolt arrangement provides radial adjustment and assures concentricity of shaft in stuffing box. Simple slippage seal adjustment, in sturdy bearing stand. Bearings easily lubricated. Motor can be direct coupled or mounted overhead.

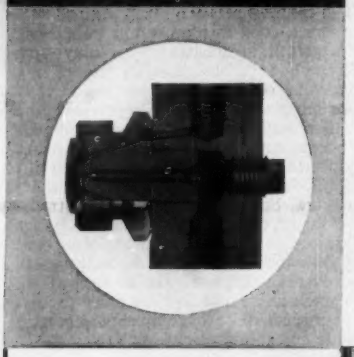
Tough jobs call for

Nagle PUMPS
FOR ABUSIVE APPLICATIONS EXCLUSIVELY

Chemical plants have found the Nagle "KC" pump a real bargain when it comes to handling corrosives. It's a pump you don't have to replace. Pump shown is performing splendidly for a Michigan processing plant. Nagle also builds horizontal and vertical shaft pumps for handling abrasive mixtures or hot solutions such as molten salt or sulphur. Write for Nagle Pump Selector. NAGLE PUMPS, INC., 1235 Center Ave., Chicago Heights, Ill.







when the problem involves corrosive liquids or gases you have the choice of

STAINLESS STEEL
HARD RUBBER
USCOLITE
LEAD
PLASTIC

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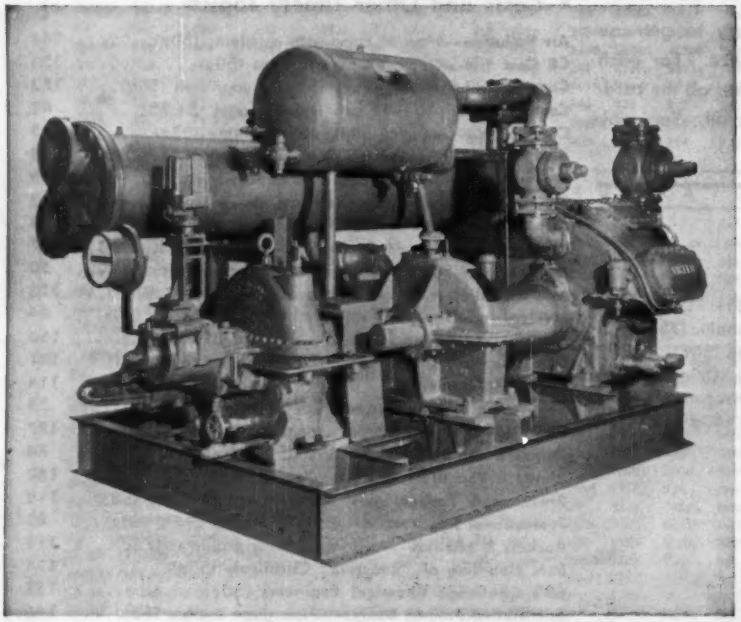

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231 *Kaiser Chemicals Div.

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207 *Enjay Co., Inc.

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107 *General Aniline & Film Corp.

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264A Dow Chemical Co.

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153-154a *U. S. Industrial Chemicals Co.

Colloidal Silicas.....Properties and characteristics of Nalcoag colloidal silicas are described in Bulletin K5, which is now available on your request.
238 *Nalco Chem. Co.

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264B Hydromatics, Inc.

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265B Evans Research Corp.

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53 *Johns-Manville

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153-154b *U. S. Industrial Chemicals Co.

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274 *Great Lakes Carbon Corp.

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155 *Wellington Sears Co.

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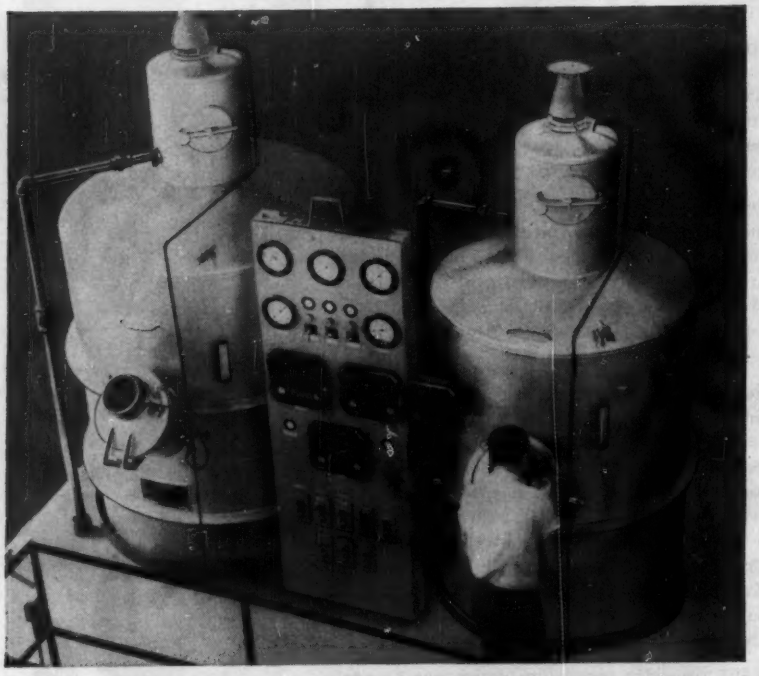

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Nitrogen Tetroxide.....can be used in the wood pulping, rubber, metal recovery & lubricant purification industries. A 59-pg. bulletin gives information & application data.
129 *Allied Chemical, Nitrogen Div.

Petroleum Waxes.....Technical paper describes structure, composition and analytical and functional properties of waxes with emphasis on microcrystalline wax.
266C Sonneborn Chemical Corp.

Platinum Catalysts.....in the production of high-purity chemicals, pharmaceuticals, vitamins & biotics. Brochure "The Role of the Platinum Group Metals as Catalysts."
91a *Engelhard Industries, Chem. Div.

Polyethylene Radiation Shields....The polyethylene panels must meet rigid specifications & require critical quality control. Can be made in standard widths over 36".
153-154d *U. S. Industrial Chemicals Co.

Resins.....Information about properties and characteristics of Teflon resins and the many ways they have led to improved economical designs is available on request.
63 *E. I. du Pont de Nemours & Co.

Silicones.....New descriptive brochure, "Why Silicone-Based Paints Mean Less Maintenance" is available. Covers the new paints based on silicone resins.
141 *Dow Corning Corp.

Sodium to Activate Carbon.....A recent study reveals that sodium treatment of activated carbon also improves its liquid adsorption characteristics.
153-154c *U. S. Industrial Chemicals Co.

Sodium Borohydride.....is now available in new product forms: Pellets, SWS stabilized water solution, & Pure Powder. Also many new applications. Technical publications.
120 *Metal Hydrides Inc.

Solvent.....Complete technical data on ethyl alcohol proprietary solvent SOLOX are given in a new, 6-page data sheet. Includes specifications, properties, etc.
153-154e *U. S. Industrial Chemicals Co.

Turbine Oil.....Nonpareil turbine oil will not permit formation of harmful acids and has high resistance to foaming. Contains adequate rust inhibitor.
150 *Standard Oil Co. (Indiana)

Construction Materials

Alloy.....The engineering properties of Ni-O-Nel alloy & detailed data on its record of corrosion resistance is contained in "The Corrosion Resistance of Ni-O-Nel" booklet.
60 *International Nickel Co.

* From advertisement, this issue

Alloy, High Temperature.....12-page booklet contains photomicrographs, tables and graphs illustrating structure and properties of material developed for jet gas turbine discs.
267A Westinghouse Electric Corp.

Aluminum.....Data file on Aluminum for Chemical Process Applications is available. Offers you assistance when designing any process system. Send for your copy.
48-49 *Reynolds Metals Co.

Aluminum Bus Conductor.....handles easily and easy to bend and form to your needs. Up-to-date facts and figures on lightweight Aluminum Bus Conductor. Handbook.
52 *Aluminum Co. of America

Coating.....Carbo Zinc 11 the new zinc filled inorganic coating for galvanic protection of steel becomes water insoluble 20 minutes after application. Tech. Data.
246 *Carboline Co.

Coating.....New Epon resin-Bitumen C coating is ideal for a wide range of anti-corrosion and water-proofing applications. Complete information available.
Cover *Shell Chemical Co.

Coatings, Spray.....Engineering data on basic flame spray processes covers metallizing process which sprays powdered metals and refractory ceramics.
267B Metco-Metallizing Co.

Coating Systems.....The Chemical Corrosion Data File includes a survey of corrosion problems in the Chemical Industry and a coating selector guide.
28-29 *Pittsburgh Coke & Chemical Co.

Coatings.....Heavy-Duty Chemical Resistant Coatings really stick to unpainted concrete floors. Complete details, including color charts & applications.
59 *Rust-Oleum Corporation

Insulating Cement.....Super "66" applies quickly to any equipment, cold or hot. Effective up to 1800 F. & it contains a special rust inhibitive which prevents corrosion.
68 *Eagle-Picher Co.

Insulation.....Mono-Block now spans the full range up to 1800 F; provides lower thermal conductivity, 0.63 at 800 F. Additional information in 1960 Catalog.
26 *Baldwin-Ehret-Hill

Metals.....One of these 3 grades; K501, K601 or K701 can provide the answer if you have corrosion and wear problems with component parts. Information on request.
265 *Kennametal Inc.

Pipe Insulation.....High-temperature Kaylo Pipe Insulation comes with an embossed aluminum jacket that locks together in quick, one-step application. New literature.
6-7 *Owens-Corning Fiberglas Corp.

Plastic Pipe.....made of A-C Pipe Compound assures lasting performance in jet wells, water transmission chemical & food processing. Sample test lengths.
213 *Allied Chem., Semet-Solvay

Platinum Clad Metals.....offer many advantages such as acid resistance, uniform platinum layer, sound metallurgical bond, etc. Bulletins PLA-1, PLA-3, & PLA-5.
14-15 *Texas Instruments Inc.

* From advertisement, this issue

exclusive direct unloading system cuts CO_2 handling costs

To be sure you get rock bottom CO_2 costs, investigate this exclusive method of handling CO_2 shipments. It's Olin Mathieson's patented Direct Unloading System in which CO_2 flows directly from special insulated tank cars to your process.

This new system bypasses intermediate steps such as storage in refrigerated tanks, handling of cylinders, or converting dry ice, along with the expensive facilities that are required. Maintenance and upkeep are reduced, valuable plant space or land is reclaimed, and a constant supply of CO_2 is available to match every demand.

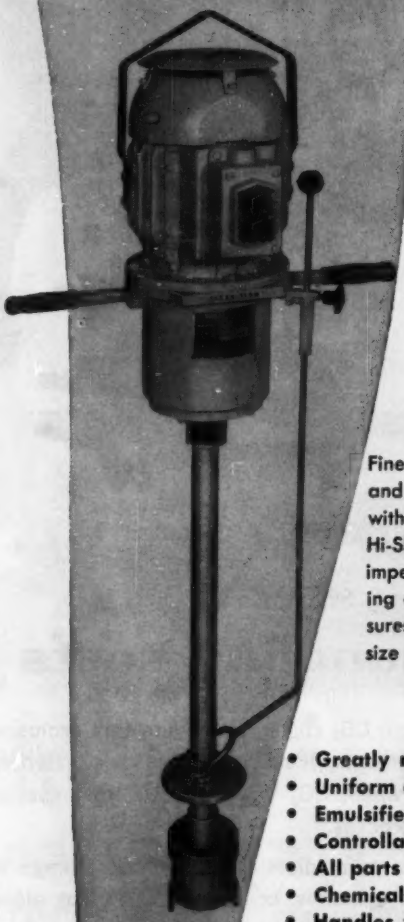
If your process requires a highly dependable, low cost source of CO_2 supply, talk over your requirements with an Olin Mathieson representative soon.

7333

Olin Mathieson
Chemicals Division • Baltimore 3, Md.

CHEMICALS

SHEAR-FLOW



the modern mixer with power shearing

Finer, faster blending, dispersing and homogenizing is now possible with Shear-Flow's new Model RL Hi-Shear Head. Finely spaced dual impellers induce considerable shearing action and high pumping pressures that rapidly reduce particle size for superior material mixtures.

- Greatly reduces mixing time
- Uniform circulation—no vortex
- Emulsifies immiscible liquids
- Controllable flow pattern
- All parts stainless steel
- Chemically inert seals
- Handles viscous materials with ease
- No operating Torque
- Disperses, blends, homogenizes

GABB SPECIAL PRODUCTS INC.
Windsor Locks, Conn.

SHEAR-FLOW
GABB SPECIAL PRODUCTS INC.

☐ Have representative call
☐ Send more information

Name_____

Position_____

Co. & Address_____

LITERATURE . . .

Protective Coating.....Specification Guide is based on recognized best practices in the industry, and contains paragraphs covering all phases of coating applications.
219 *Amercoat Corp.

Stainless Steel.....plate and plate products in a wide range of superior analyses in any thickness. Details on these grades and inventory information on all types.
71 *G. O. Carlson Inc.

Stainless Steel Tubing.....New 36-pg. booklet is packed with tech. data & authoritative information on both welded & seamless stainless steel tubing. Ref. tables & photos.
95 *Allegheny Ludlum Steel Corp.

Tank Linings.....Penton tank linings may provide the answer to your chem. storage or handling problem. Information on materials & application techniques.
93 *Hercules Powder Co.

Zinc Dust....is now being used as a reducing agent, precipitating agent, purifier, catalyst, polymerizing agent, & in rust-resistant paints, bleaches, etc. Information.
243 *American Smelting & Refining.

Electrical & Mechanical

Couplings.....Basic type F Steelflex coupling can be used horizontally or vertically, without modification or special parts. Information in Bul. 4100.
127 *The Falk Corporation

Drive.....The new Select-A-Spede offers field-proved All-Transistor Control. Sizes from 5 to 400 hp, speed ranges up to 20:1. Bulletin 2001 contains information.
146 *The Louis Allic Co.

Drives.....Variable Speed Drive is all electric & operates from a-c circuits. Information on drives ⅛ through 200 hp. contained in Bulletin No. D-2506.
61 *Reliance Electric & Engrg. Co.

Enclosures.....Spin Top enclosures are available in 4 sizes to include circuit breakers, across-the-line starters & combination starters. Details.
115 *Square D Company

Fluorescent Fixtures.....“EFU” fixtures are U.L. and C.S.A. approved and meet specifications of Article 500 of the National Electric Code. Choice of 33 different models.
1 *Appleton Electric Co.

Motor Starter & Circuit Breaker..... with compact design to permit a greater number of controls in any given area. Now available in 7″ & 9″ sizes. Detailed information.
80 *Crouse Hinds

Power Transmission Components..... Cat. SP-59 covers the complete range of roller chain drives, silent chain drives, etc. Also flexible couplings, clutches, etc.
268A Morse Chain Co.

Relays.....New Bulletin 700 Relays offer improved features including new mechanical design, complete interchangeability & new reinforced stationary contact blocks.
139 *Allen-Bradley Co.

* From advertisement, this issue

Seal.....New Grayloc Seal eliminates leaks. More information about how Grayloc can solve your leakage problems is contained in the new Grayloc Catalog.
227 *Gray Tool Co.

Seal Replacement.....New mechanical seal change cuts mixer maintenance costs. Complete details on seal replacement contained in Bulletin 601.
233 *Nettco Corporation

Handling & Packaging

Automatic Proportioning System..... Selec-O-Weigh systems incorporates Feeders, Scales, Controls, and Readout. Full details on how you can automate your processing.
244 *Richardson Scale Co.

Bucket Elevators.....Complete line includes 14 types in 4 basic designs . . . centrifugal, positive, continuous and internal discharge. Complete details.
12 *Link-Belt Co.

Containers.....with new Flip Cap make it perfect for practically all liquids & granulated products. Cap available with either ½ or ¾ inch opening.
119 *Continental Can Co.

Conveying Guide.....A 12-page conveying guide discusses types of systems, illustrates & diagrams high & low density arrangements & shows equipment. Bul. M-588.
221a *The Day Company

Drums, Stainless Steel .....for safe, contamination-free handling of acids, essential oils, solvents, perfumes, viscous materials, etc. Full specifications available.
13 *Pressed Steel Tank Co.

Fork Lift Trucks.....Bulletin 499 fully illustrates & describes the Fork Lift Trucks plus accessories and optional equipment. Available on request.
269A Allis-Chalmers

Plate Magnets.....designed to assure ease of installation in chutes, spouts, ducts, feed tables, and housings & for suspension over screens, moving conveyors, etc.
269B Eriez Mfg. Co.

Reach Truck.....Six-page folder describes electric reach truck designed for use in narrow aisles. Special features include power steering and single master control handle.
269C Clark Equipment Co.

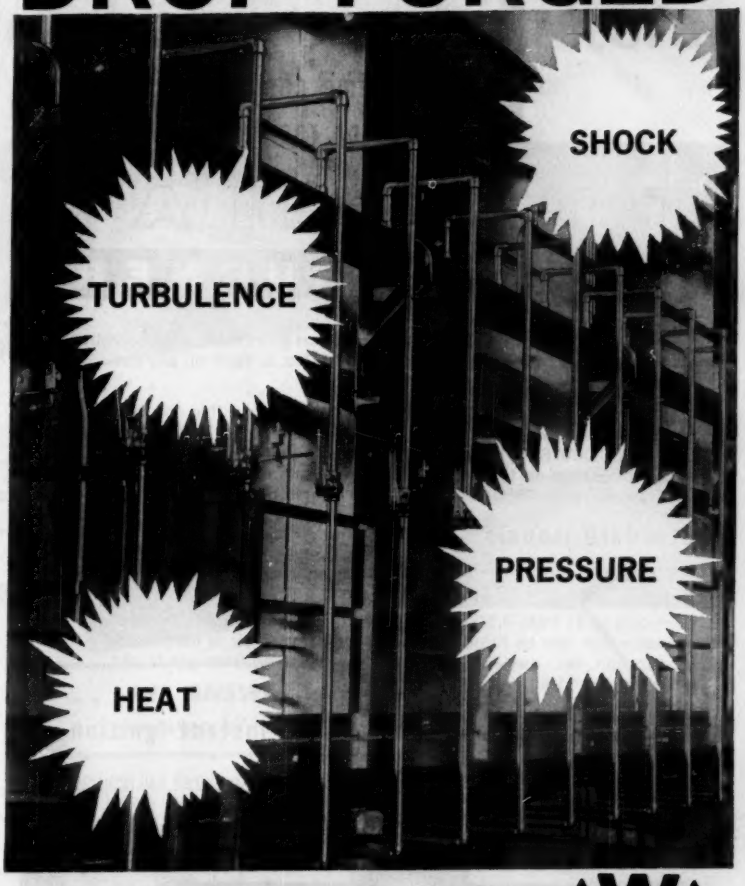
Scales.....Printweigh are available in a wide range of models including Portable, Floor & Bench types. Built-in Hopper, Overhead Track & Motor Truck types. Bul. 2017.
271 *Toledo Scale Corp.

Storage Tanks.....Bulletin 574 describes horizontal & vertical storage tanks. Filled with photos of various installations plus description of auxiliary equipment.
221b *The Day Company

Vibratory Feeders.....are completely automatic, extremely accurate. Fully enclosed drive element makes units dust & moisture resistant. Comprehensive literature.
269D Eriez Mfg. Co.

* From advertisement, this issue

DROP FORGED



For critical jobs, the brand to look for is W-S

When the piping application is most difficult, that's where you'll find W-S Forged Carbon Steel Fittings. Under the toughest conditions, these are dependable connections which stand up. Here's why:

- Drop forged for exceptionally high tensile and impact strength.
- Long, accurate threads, in perfect alignment.
- Uniform wall thickness, for safety.
- Accurate machining for tight fit.

For specifications and Distributor locations, write *Forge & Fittings Division, H. K. Porter Company, Inc., Box 95, Roselle, N. J.*

FORGE AND PORTER FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

rapid
short flame combustion
...even on residual fuel oil

THERMAL

VORTEX BURNER

Here is a versatile unit that gives rapid, clean combustion on a wide range of fuels including Bunker C, No. 6, light oil, any gas . . . even liquid organic wastes.

Combustion is 80% completed within the burner itself and takes place with a whirling, short flame that attains heat release rates of over 1,000,000 BTU/hr per cu ft. Products of combustion are clean and sufficient excess air for tempering the products may be introduced through the burner itself without causing smoke or instability.

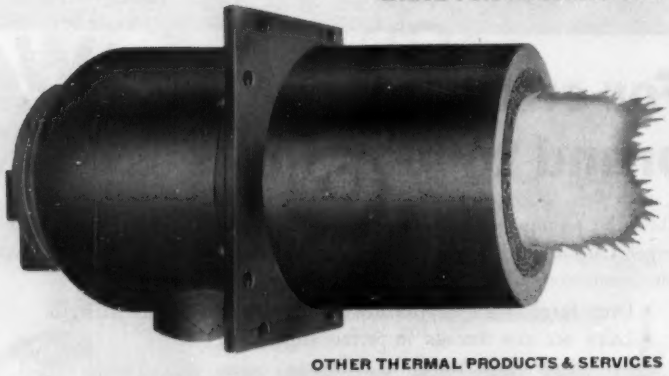
standard models available...

Complete units from 3,500,000 BTU/hr to 50,000,000 BTU/hr are available and may be fitted for steam, compressed air or mechanical atomization. With dual fuel arrangements switching from gas to oil is accomplished without shutdown.

instant ignition...

Gas-electric or torch ignition allows full ignition in a few seconds—even with a cold burner.

WRITE FOR BULLETIN #111



OTHER THERMAL PRODUCTS & SERVICES

Gas, Oil & Combination Gas-Oil Burners • Heat Exchangers • Air Heaters • Submerged Combustion • Gas Generators • Combustion & Heat Transfer Engineering

THERMAL

Thermal Research & Engineering Corp.

CONSHOHOCKEN • PENNSYLVANIA

REPRESENTATIVES IN PRINCIPAL CITIES

IHEA

Heating & Cooling

Boilers.....Bulletins describing Vogt boiler installations in a variety of industrial plants for power, processing and heating are available on request.
164 *Henry Vogt Machine Co.

Burner, Vortex.....Here is a versatile unit that gives rapid, clean combustion on a wide range of fuels. Standard models available . . . instant ignition. Bulletin #111.
270 *Thermal Research & Engineering

Condenser Tube.....Complete information about how Wolverine Trufin Type S/T can help you do a better job, is contained in Catalog.
227-228 *Calumet & Hecla, Wolverine Tube

Heat Exchangers.....The "Polybloc" impervious graphite heat exchanger is covered in a new booklet. Principles of operation, applications and complete design data included.
270A The Carbone Corp.

Heat Exchangers.....Liquid/Gas heat exchangers for any application, alloy or size. Additional information for your application is offered on request.
144 *Marlo Coil Co.

Heat Exchangers.....New 4-color Bul. 820 describes & illustrates the complete line including Standardized Heat Exchangers that fulfill nearly all normal requirements.
L251 *Manning & Lewis Engr. Co.

Heat Exchangers.....Brazed Aluminum Heat Exchanger can handle as five fluids simultaneously. Units available for either cross-flow or counter-flow operation. Facts.
30-31 *Trane Company

Heat Exchangers.....Transaire Air-Cooled units are now being used in many varied processing operations. Feature the exclusive Aimco fin-tube.
135 *Yuba Consolidated Industries

Heater.....Hi-Turbiant has two broad fields of application; heating transfer fluids & direct firing. Bulletin HT-100 gives detailed data & shows typical system.
126 *Western Precipitation Corp.

Heaters.....Bulletin "Gradiation Heating for Petroleum and Chemical Processing" discusses heat processing with Gradiation tubular heaters. Available on request.
152 *Selas Corp.

Heat Transfer Equipment.....designed, fabricated & delivered regardless of the materials required: Steel, Stainless Steel or the Nickel Alloys. Heat Exchanger Bul. No. 158-HE.
252 *Doyle & Roth Mfg. Co.

Panelcoil.....New heavy gauge embossed Panelcoil available in 5 widths from 12" to 29", in lengths up to 143". Data Sheet 15-60 Series & Price Bul. 259 offered.
TR259 *Dean Products, Inc.

Steam Jacketed Kettles.....meet every processing and mixing need. Size & type for every process or product are covered in book of engineering data & specification sheets.
R259 *Groen Mfg. Co.

* From advertisement, this issue

LITERATURE . . .

Refrigeration.....Bulletin 631 describes the Uni-Chiller. Also if you have a refrigeration or pressure vessel application, a review of your problem is available.
264 *The Vilter Mfg. Co.

Refrigeration Unit.....offers the latest concepts of external refrigeration. Type in large & small sizes. Pure argon now available on larger sizes.
220 *Independent Engineering Co.

Steam Traps.....Five traps available; Thermo-Dynamic, Thermostatic, Float-Thermostatic, Liquid Expansion, and Bucket. Literature to help you with your problems.
22-23 *Sarco Company, Inc.

Steam Vacuum Refrigeration System.....for solution to your process water requirements. Complete information on this system is contained in bulletin.
99 *Graham Mfg. Co., Inc.

Instruments & Controls

Computer.....All transistorized Analog Computer, 15 x 16" by 24" high, is powered by 115 volts AC & can provide day-in day-out solution of your problems. Bul. TR-10-A.
193 *Electronic Associates, Inc.

Instruments.....Catalog No. 2 is a brief presentation of the standardized instruments that are available including miniature instruments. Send for your copy.
69-70a *Fischer & Porter Co.

Instrument.....Milli-V-Meter is the instrument with the Tape-Slidewire for Petroleum, Chemical, Steel & Aluminum Plants to indicate temp. pressure, flow, weight & level.
224 *B & H Instrument Co., Inc.

Magnetic Flow Meter.....are lined with corrosion-proof Kel-F and have no flow restrictions of any type. Information on how it can help your process and Bul. 20-14.
134 *The Foxboro Company

Meter.....New Gyro-Integrating True Mass Flowmeter accurately measures flow of liquids, gases & liquefied-gases . . . directly in pounds. Bul. GEA-6925A, Section 599-02.
40-41 *General Electric Co.

Meters.....Industrial pH meters, measure & control pH in industrial processes. Data File 14-17-06 contains a list of companies & instrument specifications.
132 *Beckman Instruments Inc.

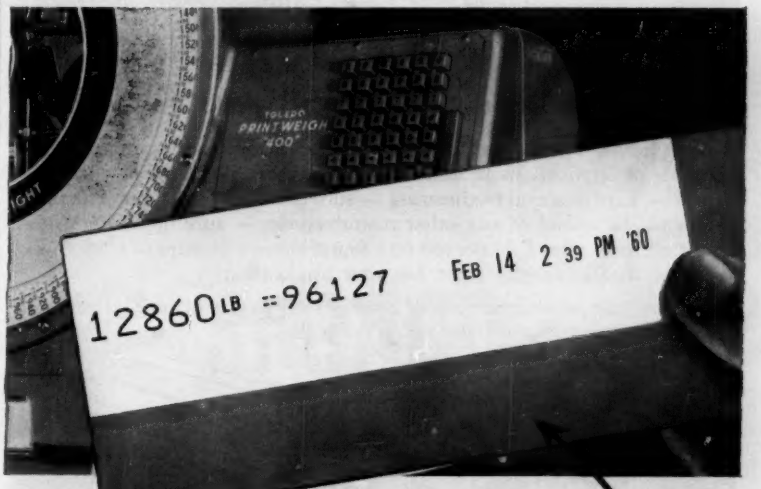
Pneumatic Transmitters.....give you a true primary and transmitted signal for indication or control. Factful Bulletins 360 and 361 can help you in your selection.
239 *Manning, Maxwell & Moore, Inc.

Pressure Gauge.....The direct-drive helical bourdon gauge offers pressure ranges from 0-1000 to 0-10,000 psi. Additional information can be found in the general catalog.
222 *Rochester Mfg. Co., Inc.

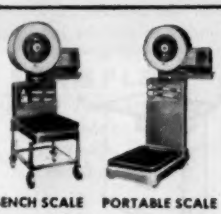
Process Control.....16-page catalog describes instruments and techniques for leak detection, mass spectrometry, chromatography and other types of analysis and control.
271A Consolidated Electrodynamics

* From advertisement, this issue

TOLEDO SCALES that PRINT Complete Weight Records for You . . .



. . . *THE ANSWER* to prevent "guesswork" and errors in cost control!



Toledo Printweigh Scales are available in a wide range of models, including Portable, Floor, and Bench types as illustrated; also Built-in, Hopper, Overhead Track and Motor Truck types.

Human errors in reading, remembering and recording weights are eliminated with Toledo Printweigh "400" Scales. They're the surest way to satisfy your requirements for weight records that are complete and indisputable.

Weights are printed in full figures, even when unit weights are used. Choice of printing on 8½" x 11" forms, or on tickets; also on strips. Weight data may be transmitted electrically for recording on remote adding or other office machines. "Memory" feature available for printing weight data, even after load is removed.

Toledo Printweigh "400" Scales give new flexibility and efficiency in weighing . . . to cut costs, guard quality, prevent profit-stealing weighing errors. Ask your Toledo representative for the full story on Printweigh Scales, or WRITE TODAY FOR BULLETIN 2017. TOLEDO SCALE, Division of Toledo Scale Corporation, Toledo 12, Ohio
(Toledo Scale Co. of Canada, Ltd., Windsor, Ont.)

"MISFIT" SCALES MULTIPLY COSTS

Scales can become "misfits" as a result of changes in plant layout, materials handling, inventory controls, value or quantity of materials weighed. If this has happened in your plant, the results can be costly. For example: weighing errors, production bottlenecks, materials handling inefficiencies. Be sure your scales are adequate for the job. Ask your Toledo representative about a scale adequacy check in your plant, or send for the Toledo Weight Fact Kit.

SERVICE

TOLEDO® *Headquarters for Weighing Systems*

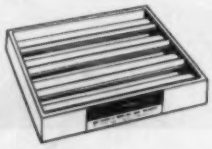
ONLY STEARNS

Indox V Magnetic Separators give you Job-Proved Protection

...and at prices you can't afford to ignore!

Stearns INDOX V ceramic magnet separators have been field-proved on hundreds of applications in almost every industry. You can be sure with Stearns — sure of sound engineering — sure of field-tested ceramic magnet experience far ahead of any other manufacturer — sure of recommendations that have been field-proved and found correct — sure of a magnetic separator that is exactly right for your application.

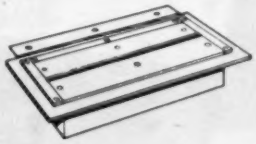
Here are four performance-proved Stearns separators that have introduced a new era of tramp-iron protection for all industry.



INDOX GRATE MAGNET

400% greater effective area

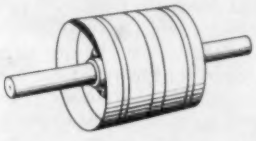
Easily installed in any hopper or floor opening, chute or duct. Guards your product and plant against dangerous tramp iron. Collecting tubes, with continuous magnetic poles along their entire length, leave no "dead" spots. Effective area is actually 400 percent greater than in ordinary grate magnets! Complete range of types and sizes for any installation. *Ask for Bulletin No. 1072C.*



INDOX V PLATE MAGNET

unbeatable low-cost protection

Provides separating efficiency far superior to ordinary plate magnets. Powerful, uniform magnetic field traps iron particles in flowing material in chutes, ducts, spouts or on conveyors. Excellent tramp-iron protection at low cost. *Ask for Bulletin No. 1074C.*



INDOX V MAGNETIC PULLEY

fail-proof protection

Can be installed at head of any belt conveyor system. Outperforms conventional permanent magnet pulleys — equals deep-field power of electromagnetic types. Radial design boosts holding power for maximum separation efficiency. Standard widths and diameters to match your present system. *Ask for Bulletin No. 1022C.*

INDOX V MAGNETIC DRUM

30 to 40% stronger field

An ideal unit for process industries where granular materials are conveyed in enclosed chutes or spouts. Revolving stainless steel cylinder inside a welded steel housing carries material over stationary magnet assembly, which holds iron particles beyond discharge of nonmagnetic product. INDOX V produces exceptionally uniform field *30 to 40 percent stronger* than old-style permanent magnet drums. Complete range of types and sizes for any installation. *Ask for Bulletin No. 1052C.*

STEARNS MAGNETIC PRODUCTS

DIVISION OF INDIANA GENERAL CORPORATION • VALPARAISO, INDIANA

635 South 28th Street • Milwaukee 46, Wisconsin

Profit with Stearns — First with Ceramic Magnet Separators for Industry

LITERATURE . . .

Pyrometer.....The Velotron Pyrometer System is ideal for no-contact, continuous temp. measurements. Complete technical data on this low-range radiation pyrometer.
136 *The Bristol Co.

Recalibration System.....A simple dial-reset screw, located on the back side of RMC thermometers, permits recalibration without opening the instrument. Catalog.
223 *Rochester Mfg. Co., Inc.

Thermocouples.....Revised 40-page file-size catalog lists all data (I.S.A. standards), components & prices. Shows how to select best thermocouple & protective tube.
258 *West Instrument Corp.

Thermometers.....American Bi-Metal thermometers feature the two-level "Maxivision" dial which eliminates parallax effects. Made of weatherproof stainless steel. Cat. 100A.
24 *Manning, Maxwell & Moore, Inc.

Torque Control Instrument..... for rolling ¼" through 4½" tubes in boilers, condensers & similar heat transfer vessels. Details and Bulletin AC-7A.
TL257 *The Gustav Wiedeke Co.

Pipe, Fittings, Valves

Fittings.....available from stock in carbon steel through 36". Also in wrought iron & chrome-moly. New brochure Seamless & Welded-type Fittings, No. 60-C.
16-17 *Midwest Piping Company, Inc.

Fittings.....Forged Carbon Steel Fittings offer uniform wall thickness, for safety & accurate machining for tight fit. Specifications & Distributor locations on request.
269 *H. K. Porter Co., Inc.

Fittings.....Every fitting marked with size, analysis, schedule & production code. Line includes eccentric, reducers, crosses, reducing tees, etc. Catalog data available.
117 *Horace T. Potts Co.

Fittings & Flanges.....Bulletin on Pipe-Mate describes the complete line, shows installation procedures & gives properties & dimensional tolerances.
38-39 *Tube Turns

Pilot Pipe.....includes a wide range of designs that handle a wide range of working pressures from 25 to 250 lbs. & also handle a wide range of chemicals & abrasives.
217 *United States Rubber

Pipe.....Saran lined pipe, fittings, valves and pumps are available for systems operating from vacuum to 300 psi, from below zero to 200 F. Information.
68 *Saran Lined Pipe Co.

Pipe, PVC.....handles acids, alkalies, salt solutions & alcohols. Available in either high-impact or normal-impact, & comes in sizes ½" to 12" in diameter. Bul. 24.
113 *Nat'l Tube Div., U. S. Steel

Pipe, Plastic.....Bulletin describes properties of fiber glass reinforced plastic pipe for chemical corrosion control. Tables and charts illustrate engineering facts.
272A Haveg Industries, Inc.

* From advertisement, this issue

LITERATURE . . .

Tube.....“The Story of Tube” is told in the colored photographs and illustrations contained in this new brochure. Includes the Tube Mill Products Selector charts.
273A Scovill Mfg. Co. Mill Prod. Div.

Valve.....The P-K Paul Control valve offers high flow capacity. They are highly resistant to erosion & wire drawing, minimize flashing & cavitation problems. Tech. Cat.
234 *General Kinetics

Valve.....New Sampling Valve cannot clog. Designed for simple installation in existing systems, merely by welding a ¾” half coupling into the pipe or vessel.
C259 *Strahman Valves, Inc.

Valves.....Type F valves are available in Durimet-20, 316 Stainless, Monel, Chlorimet-2. Chlorimet-3, & Nickel. Flanged or screwed, in sizes from ½” to 6”. Bul. V/4b.
215 *The Duriron Co., Inc.

Valves.....V-10 are available with either welded seat or replaceable seat, in addition to the Quick-change Trim design, with bolted or pressure seal bonnets. Details.
56 *Republic Flow Meters Co.

Valves, Butterfly.....Operates from simple lever to automatic & remote control. No limit in size. Construction of any metal. Details in Bul. 590X.
R277 *W. S. Rockwell Co.

Valve, Flow.....All-Neoprene-Stainless solids flow valves for blending, milling, conveying applications. Sizes 6”, 8”, 10”, 12”. Product Data Sheet 18V.
BR281 *Patterson-Kelley

Valves, Gate.....are offered in sizes, type & metals for all kinds of normal or unusual services. Catalog No. 57 is offered plus special Engineering Service.
248 *Darling Valve & Mfg. Co.

Valve, Needle.....The No. 62 is particularly suitable for sensitive control of flow . . . as in metering or sampling for process plant, laboratory, etc. Facts.
R279 *Alloy Steel Products Co.

Valves, Stainless Steel.....New catalog covers valves in the patterns you want, in a choice of alloys that satisfy the requirements of practically all corrosive services.
27 *Jenkins Bros.

Tubing.....A-X tubing is available in stainless steel & other alloys. Nominal tubing I.D.'s: 5”, 6”, 8”, 10”, 12”, 14”. Bulletin A-X 97 gives complete details.
64 *American Brass Co., Anaconda Div.

Tubing.....Information on Job-Matched stainless tubing in Bulletin TB-410. All tubing is carefully matched to your fabricating and end-product requirements.
160 *The Babcock & Wilcox Co.

Unions.....Hi-pressure Handlebar unions are available in 2” size, and have a wide application in the petroleum industry. Complete information.
65 *Clayton Mark & Co.

Valves.....Reactor valving engineered to your specific requirements. Also a complete line of butterfly valves, including models for airlock valving. Detailed information.
197 *Allis-Chalmers

* From advertisement, this issue

What are you paying for SPRAYING?

EXAMPLE:
Spraco Full-Cone Free-Flow Nozzles — for high capacity, low pressure installations

Spraco full-cone, free-flow nozzle discharging 860 gpm at 5 psi. At this shutter speed (1/5,000 sec.) pump pulsations are apparent in the spray pattern.

To answer a long felt processing need, Spraco recently developed a totally new line of full-cone, free-flow nozzles for high capacity, low pressure installations where clogging is a problem and a full-cone spray a necessity. Featuring streamlined internal vane construction with maximum vane openings, they offer minimal flow resistance, virtually eliminate clogging.

Now widely used in cooling towers, coke quenching, aerating and purifying water supplies, and a host of chemical processing applications, Spraco Full-Cone Free-Flow nozzles are another excellent example of how Spraco cuts the cost of spraying by increasing the efficiency of the system.

What's your spray nozzle problem? Spraco offers the most complete range of nozzle sizes and capacities available anywhere, always in stock, and made from bronze, cast iron, stainless steel, or, to order, from any special machineable material.

Write today for the most comprehensive spray nozzle catalog ever published. Complete, accurate performance data for each of the hundreds of spray nozzles in the line.

SPRAY ENGINEERING COMPANY, *115 Cambridge Street, Burlington, Mass.*

SPRACO

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A Family of Specially-Processed Carbon-Based Filteraids

Mr. Roy Warren, Plating Foreman, Ford Motor Co. Monroe Plant

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Nerofil was developed for all difficult filtrations and is available in a full range of six grades, for any application you may have. Other important advantages are—Uniform Quality—Physically and Chemically Stable—Combustible Filtercake—Fast Flowrates, Good Clarity—Lower Cake Density Gives Additional Savings.

Whatever your filtration problem may be, our staff of qualified filtration engineers will be ready to assist in its evaluation. Through its Dicalite Dept., Great Lakes Carbon Corp. has for a generation been of service to industry in the solving of filtration problems. Write today for your free Nerofil Brochure.

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LITERATURE . . .

Valves, Control.....The many special advantages of control valves are described in an informative new booklet, "What's in it for you?". Copies available.
72-73 *Minneapolis-Honeywell

Valves, Diaphragm.....are widely used in many fields. You can get body, lining and diaphragm material to meet your particular service conditions. Facts.
148 *Grinnell Co.

Valves.....are available in sizes ½" thru 24" and with a complete line of automatic actuators. For almost any chemical service line. Details on request.
138 *DeZurik Corp.

Valves.....Chemical Porcelain valves practically never need maintenance or replacement. Y-Valves & Angle Valves, in ½" to 6" sizes. Also safety valves, pipe, etc. Cat. 567.
143 *Lapp Insulator Co., Inc.

Valves.....precision-designed special valves to handle molten metals & other radioactive materials in atomic power plants. Complete information.
199 *The Wm. Powell Co.

Valves.....Non-lubricated Ball Valves feature full bore conduits, Teflon stem gaskets & seats that are sealed from the lading flow. Sizes ½" through 6'. Cat. 1000.
211 *W-K-M Div. of ACF Industries

Process Equipment

Agitators & Mixers.....Turbine-type propeller (to 120" in tanks to 50" dia.) slow speed, high speed, air lift, vertical turbine mixers, mixer-settler units. Bul. A2-B2.
230a *Denver Equip. Co.

Attrition Scrubbers.....High power input to efficiently remove sand coating, mix dense slurries. Rubber lined or acid-proof tanks. Sizes to 56". Bul. A-8505.
230b *Denver Equipment Co.

Automatic Palletizer.....Completely automatic, operatorless unit is specifically engineered to slash production costs in 2 & 3 shift plants. Bulletin.
R255 *Miller Engineering Corp.

Ball & Rod Mills.....offer operation & convertibility. Wet or dry grinding systems. Sizes to 10' x 20'. All steel construction. Bulletin B2-B20.
230c *Denver Equip. Co.

Centrifugal.....Brochure describes machine that allows friable crystals to be charged into machine at top speed without crystal degradation. Cross-sectional sketch included.
274A Baker Perkins Inc.

Classifier.....The "Overdrain" Classifier is a completely new device in the field of mechanical wet classifiers. Acid-proof construction available. Catalog 39-C-11.
R251 *Hardinge Co.

Continuous Centrifugal.....Bowl diameters range from 6 to 54 inches, separating forces from 30 to 3000 gs. Each size is subject to 25 variations in design. Facts.
2 *Bird Machine Co.

* From advertisement, this issue

LITERATURE . . .

Continuous Dehydrator.....For deliquefying crystalline solids & fibrous pulps at high capacity, 4 sizes with solids handling capacity up to 70 tons or more per hour. Lit.
67 *The Sharples Corp.

Cyclones.....Shave-Off harnesses the double-eddy current to convey the dust "fines" downward quickly. Cyclone Catalog No. 103 has additional information.
240 *The Buell Engineering Co., Inc.

Discs.....Material in process can be viewed continuously. Binder is unnecessary in many cases. Bulletin No. 247 covers all the features. Available on request.
R280 *Dravo Corporation

Dissolvers.....The new Super Series are high speed, high shear, impeller-type units. Handle viscosities in excess of 50,000 centipoises. Information.
R257 *Morehouse Cowles, Inc.

Drying System.....Fluidized Bed equipment offers accurate, instantaneous temp. control & high heat transfer. System is particularly useful for crystalline chemicals, etc.
122 *General American Transportation

Dust Filter.....The Dynaclone has new "Resist-O-Wear" filter bags that gives as much as three times longer bag life. A 36-page Catalog 104 is offered.
256 *The W. W. Sly Mfg. Co.

Evaporators.....the line includes: Natural & Forced Circulation, Downflow, Agitated Film Roto-Vak, Crystallizers, Calandrias, Single & Multiple effects. Catalog 372.
266 *Blaw-Knox, Buflovak Equip. Div.

Evaporators.....Detailed information on the unique design and the high efficiency of these evaporators is contained in Bulletin #PP 509-1 which is offered.
275 *Goslin-Birmingham Mfg. Co.

Filters.....8-page bulletin describes multiple-surface porous stainless steel filters that can meet a wide range of flow rates, temperatures, pressures and slurries.
275A Pall Corp.

Filter Press.....can be equipped with any type of plates—made of virtually any material—to handle any filterable mixtures—and most filter media. Sperry Catalog offered.
131 *D. R. Sperry & Co.

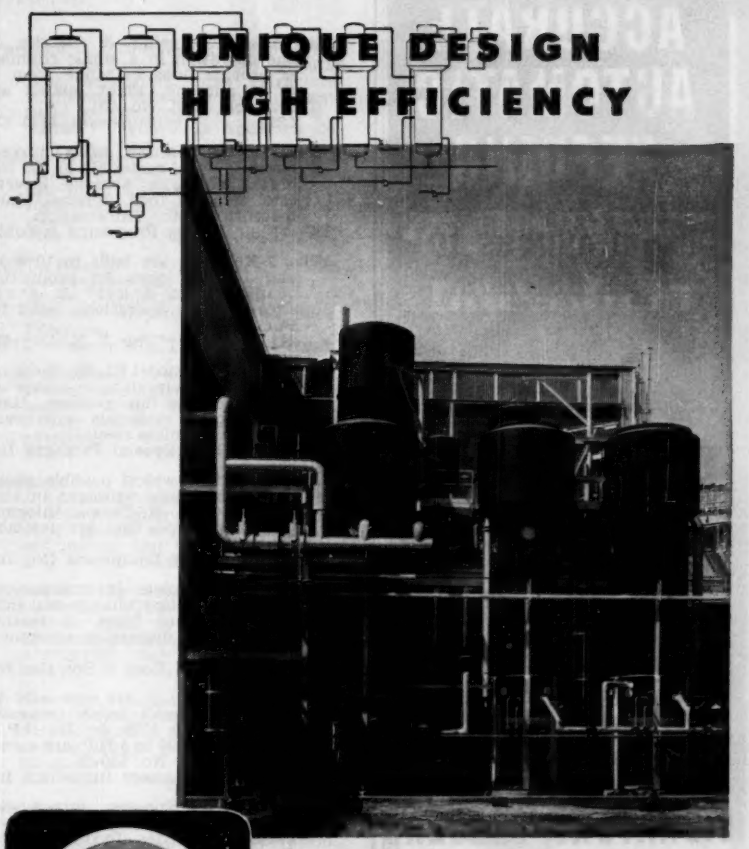
Gas Scrubbers.....Copy of a new brochure giving complete data on Chemico Venturi gas scrubbers is offered. Also, technical assistance on a specific problem.
25 *Chemical Construction Corp.

Homogenizers.....provide the practical solution to particle control. Bulletins on Homogenizers H-55, Sub-Micron Dispersers SMD-55 & Colloid Mills C-57 available.
109 *Manton Gauline

Jaw Crushers.....Cast steel frame, anti-friction side bearings & bumper bearings. Manganese steel jaw and check plates. Bulletin C12-B12.
230d *Denver Equipment Co.

Laboratory Homogenizer.....Bulletin outlines the theory of homogenization & explains the operation of the homogenizer. Lists type of products that can be processed.
275B Manton-Gaulin Mfg. Co., Inc.

* From advertisement, this issue



GB

BLACK LIQUOR EVAPORATOR at NEW SOUTHERN PAPER MILL

This six body, sextuple effect evaporator system was installed in a U-shaped arrangement and was designed to concentrate 428,000 lbs. of black liquor from 14 per cent to 50 per cent solids content, when supplied with 56,000 lbs. per hour of 45 psi steam. The high efficiency of this system (5.52 lbs. of water per pound of steam) was made possible through a new and novel feed arrangement into the evaporators. The first effect evaporator is equipped with 2 inch diameter stainless steel tubes while the other five have welded seam carbon steel tubes.

For more detailed information write for bulletin #PP 509-1

GB

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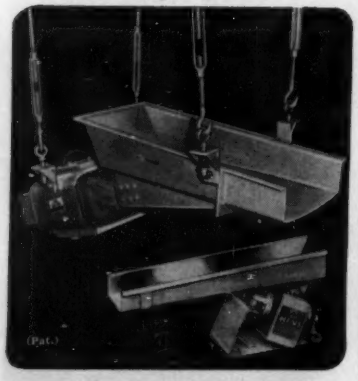
MANUFACTURING CO., INC.
P.O. BOX 631 • BIRMINGHAM, ALABAMA

FILTERS / EVAPORATORS / PROCESS EQUIPMENT
CONTRACT MANUFACTURING
including HEAVY CASTINGS

ACCURATE AUTOMATIC FEEDING

from ounces to tons per hour



ERIEZ HI-VI VIBRATORY FEEDERS

Only feeders with totally enclosed drive element as standard construction. A-C operated, electro-permanent magnetic drive

Continuous, uniform flow of feed of all sizes and shapes of bulk materials for blending, mixing, sorting, cooling, etc. Variable feed rate. Completely automatic, extremely accurate. Increases production, provides quality control, reduces maintenance and operating costs.

Fully enclosed drive element (standard—no extra cost) makes units dust and moisture resistant; ideal for sanitary applications. Break-resistant glass fiber springs • New patented magnetic drive provides greater feeding capacity than comparable size units • No rectifier needed • Simple installation • Factory pre-tested • Fully proved in plants everywhere

NOW AVAILABLE! . . . economical, specially constructed units for hazardous dusty locations . . . fully acceptable by Mill Mutual.

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Eriez Mfg. Co., 74DB Magnet Drive, Erie, Pa.

ERIEZ

LITERATURE . . .

Micronizers.....grind & classify in one operation in a single chamber & provide fines in range from ½ to 44 microns. Eight models are available. Bul. No. 091.
L277 *Sturtevant Mill Co.

Mill.....Jet-O-Mizer Mills process many types of materials in the following industries; abrasive, insecticide, ceramic, food, mineral, pharmaceutical, etc. Information.
237 *Fluid Energy Processing & Equip.

Mills, 3-Roll.....are built in 10" x 22" and 14" x 30" sizes for production quantities; in 5" x 12" & 4" x 8" sizes for pilot operations. Send for Bul. 158.
241 *The J. H. Day Co.

Mixer.....New model RL Hi-Shear offers uniform circulation—no vortex, & controllable flow pattern. Handles viscous materials with ease. All parts stainless steel.
268 *Gabb Special Products Inc.

Mixers.....The widest possible choice of standard mixer designs in sizes up to 500 hp. Additional information on all types that are available on request.
296 *Mixing Equipment Co., Inc.

Mixers.....Complete information on Double Planetary change can mixers and other types of mixing, grinding, or dispersing equipment is offered.
L280 *Chas. Ross & Son Co., Inc.

Mixers, Portable.....are especially designed for small batch processes. Speeds of 420, 1125, & 1725 R.P.M. rated from 1/20 to 3 H.P. are standard. Bulletin No. 530-B.
R247 *Eastern Industries, Inc.

Mixing.....Ko-Kneaders mix a wide variety of products such as plastics, carbon electrodes, food specialties, floor tile, solid rock propellant fuel & many others. Manual K-57.
147 *Baker Perkins Inc.

Mixing.....Model LF Mix-Muller has ¼ to ¾ cu. ft. capacity. Has machined crib & mullers; discharge is automatic, by bottom door. Handbook on Mulling.
161 *National Engineering Co.

Process Equipment.....Rubber-lined processing equipment to meet the most specific corrosion or abrasion-resistant services. Rubber Division bulletin offered.
140 *Industrial Filter & Pump Mfg.

Process Equipment.....“Sub-A” Flotation is available in sizes from 16" x 16" to 72" x 72". “Cell-to-Cell”, “Free-Flow”, and Type “M”. Bulletin F10-B86.
230f *Denver Equipment Co.

Process Equipment.....Eureka Sanimix gives accurate, uniform blending from light-dry to heavy-dense materials. Catalog covers all equipment that is available.
226 *S. Howes Co., Inc.

Process Equipment.....The 4-page illustrated bulletin on Turbo-Mills and the 6-page bulletin on Turbo-Pulverizers are available on request. Send for your copy.
245 *Pallmann Pulverizer Co.

Processing Vessels.....Welded aluminum tanks, pressure vessels and processing equipment for the chemical and processing industries. “Tank Talks” available.
TL281 *R. D. Cole Mfg. Co.

* From advertisement, this issue

ERIEZ

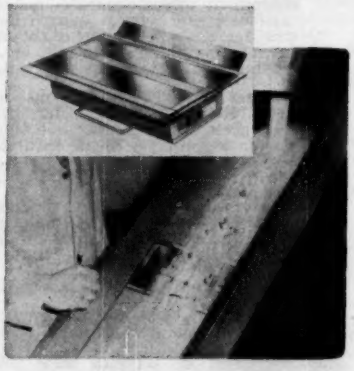
NEW SERIES 17

Erium-powered

PLATE MAGNETS

Greatest magnetic strength per dollar ever offered!

New Construction and Design ...New Magnetic Power



Protect your machinery and production. Safeguard your product quality and reputation. Eriez Series 17 Plate Magnets can pay for themselves many times over in many ways.

All welded steel and stainless steel construction is standard on these all-new plate magnets in every model. They're more compact and rugged than previously available models . . . and designed to assure ease of installation in chutes, spouts, ducts, feed tables, and housings; and for suspension over screens, moving conveyors, etc. Wide mounting flange for better, easier dust-tight installation. Uniform dimensions for greater interchangeability.

Tops for performance because of their Erium-powered* magnetic circuit providing intense concentration of power in the most essential areas (three strengths available).

**Erium—an exclusive, high quality permanent magnetic power source specifically designed and energized by Eriez.*

Here's the finest, most versatile plate separator performance at the lowest dollar cost. Write today for complete data on Series 17 Plate Magnets to:

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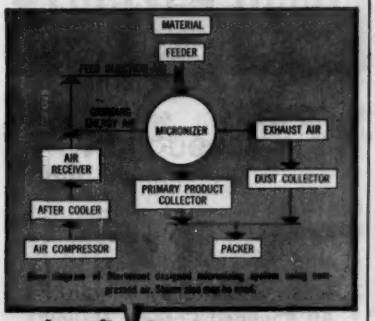
ERIEZ

Need ½ to 44 Microns?

Sturtevant Micronizers* Make 325 Mesh Obsolete



One Operation Reduces, Classifies

Sturtevant Micronizers grind and classify in one operation in a single chamber—provide fines in range from ½ to 44 microns to meet today's increased product fineness needs. Can handle heat-sensitive materials.

Production Model (15 in. chamber)

No Attritional Heat

Particles in high speed rotation, propelled by compressed air entering shallow chamber at angles to periphery, grind each other by violent impact. Design gives instant accessibility, easy cleaning. No moving parts.

Classifying is Simultaneous

Centrifugal force keeps oversize material in grinding zone, cyclone action in central section of chamber classifies and collects fines for bagging. Rate of feed and pressure control particle size.

Eight Models Available

Grinding chambers range from 2 in. diameter laboratory size (½ to 1 lb. per hr. capacity) to large 36 in. diameter production size (500 to 4000 lbs. per hr. capacity). For full description, request Bulletin No. 091.

Engineered for Special Needs

A 30 in. Sturtevant Micronizer is reducing titanium dioxide to under 1 micron at feed rate of 2250 lbs. per hr. For another firm, a 24 in. model grinds 50% DDT to 3.5 average microns at a solid feed rate of 1200-1400 lbs. per hr. A pharmaceutical house uses an 8 in. model to produce procaine-penicillin fines in the 5 to 20 micron range. Iron oxide pigment is being reduced by a 30 in. Micronizer to 2 to 3 average microns.

Sturtevant will help you plan a Fluid-Jet system for your ultra-fine grinding and classifying requirements. Write today.

Can Test or Contract Micronizing Help You?

Test micronizing of your own material, or production micronizing on contract basis, are part of Sturtevant service. See for yourself the improvement ultra-fine grinding can contribute to your product. Write for full details. STURTEVANT MILL CO., 100 Clayton St., Boston, Mass.

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LITERATURE . . .

Purifiers.....Specification Manual 803 contains data on 13 types of purifiers, separators, mist extractors, scrubbers. Available on request. Send for your copy.
TR281 *The V. D. Anderson Co.

Reagent Feeders.....Both wet and dry feeders are available. Many standard units in stock. Complete information contained in Bulletin F6-B8.
230e *Denver Equip. Co.

Ribbon Blender.....features all welded construction and approved sanitary design. Quickly demounted for cleaning. All sizes usually in stock. Brochure.
R278 *Falcon Mfg. Div. of First Mach.

Rotary Airlock Feeders.....for dust control and pneumatic conveying. Bulletin P58, "How to Select A Rotary Airlock Feeder" is now available.
BL257 *Prater Pulverizer Co.

Samplers.....Continuous mechanical & automatic types for dry, solution or slurry sampling. Complete sampling plants & sample processing equipment. Bul. S1-B4.
230j *Denver Equipment Co.

Screens.....for efficient wet or dry screening. "True-Circle" eccentric action. Sizes to 6' x 14' in stock. Trommel Screens in sizes from 30" x 60" x 120". Bul. S3-B15.
230k *Denver Equipment Co.

Screens.....Complete information on new Conidure and Rima Screens can be found in the new illustrated catalog which is available on request.
124 *National-Standard Co.

Scrubber.....Type VO Oriclone Scrubber is a completely integrated unit that performs the entire separation cycle. No subsequent collector is needed. Details.
50 *The Ducon Co., Inc.

Separator, Indox Grate Magnet.....is easily installed in any hopper or floor opening, chute or duct. Guards your product & plant against dangerous tramp iron. Bul. 1072C.
272a *Stearns Magnetic Products

Separator, Index V Plate Magnet..... Powerful, uniform magnetic field traps iron particles in flowing materials in chutes, ducts, spouts, or on conveyors. Bul. 1074C.
272b *Stearns Magnetic Products

Separator, Index V Magnetic Pulley .....can be installed at head of any belt conveyor system. Standard widths & diameters to match your present system. Bul. 1022C.
272c *Stearns Magnetic Products

Separator, Index V Magnetic Drum.... is an ideal unit for process industries where granular materials are conveyed in enclosed chutes or spouts. Bul. 1052C.
272d *Stearns Magnetic Products

Sifters.....Gyro Pedestal sifters feature high speed gyratory action. More data on the Gyro Pedestal sifter is contained in Bulletin 139 which is offered.
253a *Sprout, Waldron & Co., Inc.

Solids-Processor.....adds vacuum drying to liquid-solids blending. Systems completely packaged. Available in standardized models with charge capacities 1-50 cu. ft.
82-83 *Patterson Kelley

* From advertisement, this issue

VALUE ENGINEERING PROVES

ROCKWELL *Resilient-Seated* Butterfly Valves *STAND OUT*

- Weigh Less—Cost Less
- Need Less Space
- Easier to Install
- Always Operable
- Low Pressure Drop
- No Fouling
- Negligible Maintenance
- Simplified Control —Manual or Remote

Bodies lined with any elastomer—from natural rubber to Viton.

Construction of any metal.

Operates from simple lever to automatic and remote control. No limit in size.

Let Bulletin 590X help you put value engineering to work on your valve applications. Just mail the coupon below.

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LITERATURE . . .

Spiral Rake Thickeners.....move settled materials to center in one revolution. Acid proof construction available. Further information in Bul. T5-B6.
2301 *Denver Equipment Co.

Spray Nozzle.....A comprehensive spray nozzle catalog is available. Contains complete, accurate performance data for each of the hundreds of spray nozzles in the line.
273 *Spray Engineering Co.

Spray Nozzle.....Catalog 24 is a complete 48-page reference catalog for complete technical information on thousands of standard spray nozzle types & capacities.
260 *Spraying Systems Co.

Unit Machines & Systems.....Packaged processing systems include machinery for crushing, mixing, grinding & sifting plus pneumatic conveying systems. Bul. F-19.
253b *Sprout, Waldron & Co., Inc.

Air Compressors.....16-page brochure on compressed air for industrial requirements contains detailed discussion of construction features of companies industrial compressors.
278A Cooper Bessemer Corp.

Pumps, Fans, Compressors

Centrifugal Compressors.....operate in a range of flows & pressures new to centrifugal equipment. New illustrated brochure describes centrifugal gas compressors.
62 *Solar Aircraft Co.

Compressor.....The WGO-9 supplies air free of contamination because it uses no lubrication in the cylinder. Capacities run from 95 cfm-15 hp, to 939 cfm-75 hp.
203 *Joy Mfg. Co.

Compressors, Dynamic.....supplied in sizes from 15 to 15,000, & designed for any class of service from furnishing plant air to compressing hot process gases. Bul. 348-11.
205 *Joy Manufacturing Co.

Pump.....Available in all metals and alloys in a complete range from 1½" to 16". Features large diameter shafts & heavy duty bearings. Bul. 203-8.
291 *Lawrence Pumps Inc.

Pump.....The type "KC" is designed to live with corrosive liquids. Horizontal & vertical shaft pumps for handling abrasive mixtures also available. Pump Selector offered.
BL259 *Nagle Pumps, Inc.

Pump.....The chemical positive displacement pump incorporates many outstanding features such as twin-balanced impellers, self-priming, etc. Catalog P 302.
225 *Waukesha Foundry Co.

Pumps, Hydraulic Pressure.....Bulletin 238 Rev. 2 covers forged barrel type. Includes specifications, outlines important features & chart of sizes & capacities.
278B Warren Pumps, Inc.

Pump, Vertical Turbine.....Bul. 200 describes applications of these pumps for water wells serving municipalities, industry & agriculture, etc.
123c *Layne & Bowler, Inc.

* From advertisement, this issue

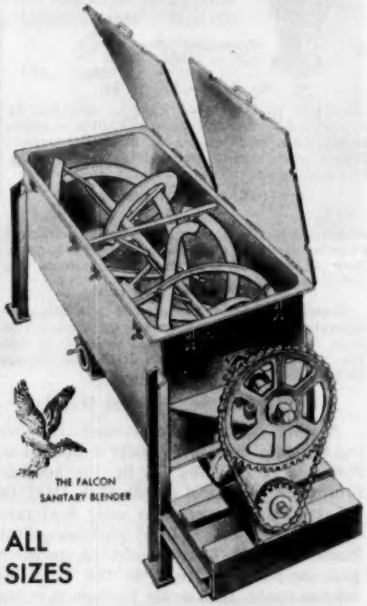
The FALCON RIBBON BLENDER
"the TOP-FLIGHT Mixer"

- **POWER**
- **PRODUCTION**
- **PRICE**

FEATURES . . .

- *All Welded Construction*
- *Mild Steel or Stainless*
- *Approved Sanitary Design*
- *All Rounded Corners Thruout*
- *Quickly Demounted for Cleaning*
- *Extra Heavy Shafts and Ribbons*
- *Leak Proof-Dust Tight Outlet*
- *All Sizes Usually in Stock*

MANY REPEAT ORDERS FROM PLANTS NOW USING FALCON MIXERS



ALL SIZES

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OF THE
FIRST MACHINERY CORP.
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BROOKLYN 15, N. Y.
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. . . one of a series presented by Western Supply Company, Tulsa, to improve the "I.Q."* of engineers . . . (*"Income Quotient")

Communicating your convictions gains better understanding, improved relations, greater results for engineers

Breathes there a man with soul so dead, who never to his friend has said, "Don't those lamebrains in the_____ Department every get ANYTHING right? . . . . I very carefully wrote EVERYTHING down, very logically and clearly . . . didn't leave a thing out . . . and they still don't get my point!" — or words to that effect?

The only qualification you need for having voiced these sentiments is that you occupy yourself daily with one or more **people**, because it is with **people** that communications break down — people on either end of the chain of communication, whether they be employee or employer, buyer or seller, veteran or newcomer. **(See Footnote)**

Whether it be an internal or external message, verbal or written, a telephone message or a memorandum, a formal report or a business letter, technical or elementary, a progress report or a comparative, scientific analysis, the ground-rules are the same for successful communications.

Take our friend who is beset by "those lamebrains," for instance. Can he be so positive that it was the **other** end of the chain that bogged down? Perhaps he was **too complete** in his instructions, where simplicity would have sufficed. Perhaps the receiver merely needed short, concise directions, not the logical, careful rationalization of the writer. Perhaps his memorandum was clear to **him**, but maybe the "practical examples" he gave weren't so practical to the recipient because it was **outside his frame of reference**, background or experience. Maybe a telephone call would have been a more efficient medium of exchange in this instance.

The basic problem, then, is one of needing to transmit our beliefs, decisions, conclusions from us to someone else, and to have that other person **understand what we mean** — quickly, accurately, simply and — pleasantly.

Perhaps one of the cardinal rules for better communications, then, is **better understanding**: consideration for others, and a **desire** to understand another's viewpoint. Actually, this merely bespeaks the real origin of "fluid communications": **thought**, for thought plays a vital role in what we feel, observe, write, say, or demonstrate; and these **are** the principal means of communication available to everyone: thinking, feeling, observing, writing, saying, demonstrating. **(See Footnote)**

Does this sound like a monumental, life-long task? It is, and it isn't. It is **not** monumental unless you make it so by resenting it, and it **is** life-long, because as you change, as others change, as business changes, so do communication forms, vocabularies, meanings, frames of reference.

It is not sufficient in a competitive economy to **have** convictions; it is necessary to **sell** your convictions to someone who can either do something with them, or authorize you to do so. This, then is one of the chief values of communications; to help you accomplish your aims in engineering, in your professional life, more quickly, more productively, more successfully. Combined with your technical knowledge, your ability to perform and deliver, and your initative, communications can become the most valuable tool in your professional "workshop."

FOOTNOTE: For more detailed information on this subject, write for "Fluid, Fluent Communications," to WESTERN SUPPLY COMPANY, HEAT EXCHANGER DIVISION, P. O. BOX 1888, TULSA, OKLA. — and if there's a heat exchanger in your company's future, we'd appreciate a "line of communication" from you!

LITERATURE . . .

Pumps.....Complete information on capacities, pressures and sizes contained in reprint (Data Sheet 100). Answers to your pumping questions, sent on request.
128 *Aldrich Pump Co.

Pumps.....Bulletin 4700 G describes the complete line of Industrial pumps with emphasis on pumps for Gasoline, Jet Fuel, Industrial Solvents & similar liquids.
57 *The Deming Co.

Pumps.....SRL (Rubber Lined) pumps offer high efficiency, low horsepower. Sizes to 5000 g.p.m. Additional information in Bul. P9-B10.
230i *Denver Equipment Co.

Pumps.....in sizes from 200 gph to 800,000 gpm, and to 3000 psi . . . for every industrial use. Brochure "Hydrodynamics" is available on request.
200 *Fairbanks, Morse & Co.

Pumps.....A type for your particular application. Bulletin V-837 describes vertical pumps and Bulletin C-355 covers the horizontal type pumps.
254 *Taber Pump Co.

Pumps.....Pumping parts are available in a variety of metal alloys, as well as plastic, to cover a wide range of corrosive applications. Complete details.
295 *A. R. Wilfley & Sons, Inc.

Pumps, Centrifugal.....The general service Uni-pump for top performance from 10 to 2000 GPM. Complete information on all pumps on request.
R249 *The Weinman Pump Mfg. Co.

Pumps, Diaphragm.....Stroke can be adjusted while pump is operating. Sizes 1" to 10" simplex and duplex, capacity to 1000 g.p.m. Bulletin P8-B12 offered.
230g *Denver Equipment Co.

Pumps, Vacuum.....in a variety of applications for chemical processing, general manufacturing, etc. Full details in Bulletin VP-158 (RCV) and S-RVS-159 (RVS).
151 *Roots Connersville

Pump, Vacuum.....Complete information about the new Series H Microvac pump is available. Also a free vacuum slide calculator is offered to you.
L247 *F. J. Stokes Corp.

Pumps, Vertical Centrifugal.....for handling frothy liquids or coarse, sandy slurries, constant or intermittent flow. Capacity to 450 gpm. Bulletin P10-B5.
230h *Denver Equipment Co.

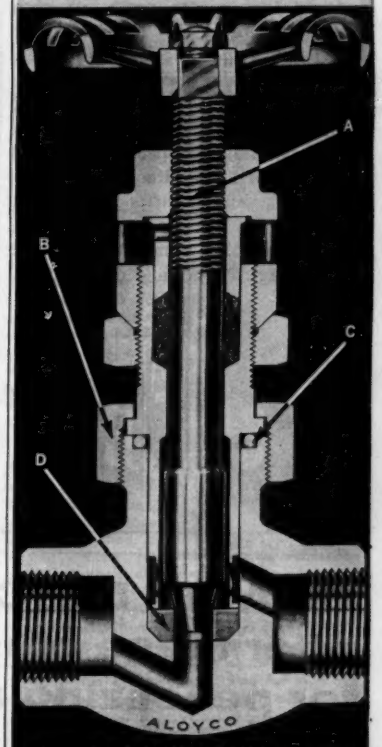
Pumps, Water & Brine.....designed to meet the heavy demands of processing plants. Bul. H-1208 covers them in detail & shows the dimensions & a selection chart.
279A The Creamery Package Mfg. Co.

Services & Miscellaneous

CO_2 Manufacturing System.....Bulletin explains features and includes schematic flow diagram illustrating operation. Available in both English and Spanish.
279B DeMarkus Corp.

* From advertisement, this issue

Stainless Steel* Aloyco Needle Valve eliminates leakage and galling!



A. OUTSIDE STEM THREADS are away from corrosive area, prevent galling.
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O.4

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Manufactured under license agreement with Lurgi of Frankfort, Germany.

LITERATURE . . .

Engineering & Building.....To learn more about Kellogg's background in engineering & building olefin plants, at home & overseas, request the current Kelloggram.
145 *The M. W. Kellogg Co.

Fabrication.....of reactors, pressure vessels, vacuum tanks, etc. Newly published, easy-to-read, illustrated booklet, "Facilities and Products" is available.
294 *Newport News Shipbuilding

Fire Control Chart.....Revised chart explains three classes of fires and type of portable extinguisher to be used on each. Includes operating instructions and recharging periods.
280A Walter Kidde & Co.

Gravel Wall Well.....Bul. 900 gives a complete explanation of gravel wall well construction & accompanying shutter screen use. Also complete specification data.
123b *Layne & Bowler, Inc.

Industrial Dermatitis.....Literature describes barrier cream that protects workers handling acids, alkalis and other irritants. Two forms are available for dry and wet work.
280B Ayerst Laboratories

Laboratory Appliances.....48-page catalog describes scores of instruments, appliances and laboratory apparatus. Full descriptions and prices of all items given.
280C Fisher Scientific Co.

Lens Cleaning Cabinet.....provides all necessary cleaning & anti-fog materials for glass & plastic safety glasses, goggles & face shields & personal glasses.
33 *American Optical Co.

Lubrication.....The Barrel-to-Bearing method will more than meet every need for high-pressure lubrication, filling hydraulic systems, servicing oil reservoirs, etc. Catalog.
125 *Stewart-Warner, Alemite Div.

Plant Equipment.....Booklet entitled "Products for the Plant" features representative machines in each category of product line. Design features are noted.
280D Ingersoll-Rand Co.

Safe Handling Procedures.....Chemical safety data publication SD-77 describes procedures for handling sulfur monochloride and sulfur dichloride. (30c.)
280E Manufacturing Chemists' Assoc.

Stainless Analyses Chart.....Revised data chart provides analyses specifications for 58 different types of stainless steel. Tabbed for quick reference, printed on card stock.
280F Peter R. Frasse & Co.

Tank Cleaning Unit.....Model 531 automatically sprays hot cleaning solution under pressure. Nozzles rotate vertically & horizontally. Rinses after cleaning. Details.
250 *Oakite Products, Inc.

Ventilating Systems.....Duracor ventilating systems & components provide outstanding resistance to attach from all types of corrosive fumes. New Ceilcote catalog.
292 *The Ceilcote Co., Inc.

Well Water Systems.....Bul. 100 gives general facts & information on systems, pumps, drilling & allied services & equipment. Also special water well drilling, service work, etc.
123a *Layne & Bowler, Inc.

* From advertisement, this issue

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Pipeline processes to operate at top efficiency must be kept clean. Hi-eF Purifiers remove contamination from process gas and air lines, entrainment from vapor lines following evaporation, and condensate and oil from compressed gases. The unique two-stage Hi-eF design principle of separation results in low-cost, filterless, maintenance-free operation. SPECIFICATION MANUAL 803 contains data on 13 types of purifiers, separators, mist extractors, scrubbers. Write SEND FOR FREE BOOKLET.

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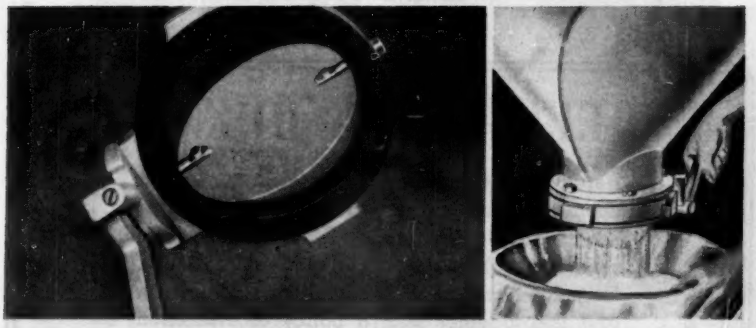
ALL-NEOPRENE-STAINLESS
P-K SOLIDS FLOW VALVE



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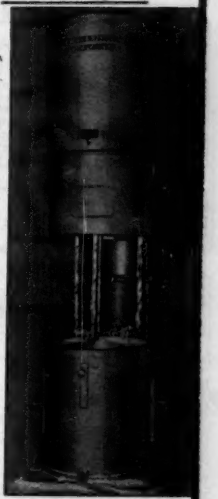
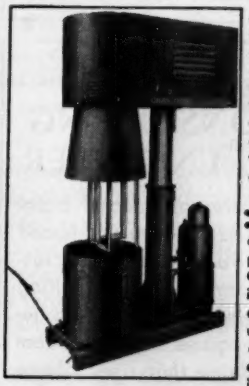
ROSS DOUBLE PLANETARY
Change Can Mixers give better mixing in less time!

At Thiokol solid propellant plant in Elkton, Md., this Ross #130CDM variable speed 100 gallon Mixer produces the same high quality mix as obtained in Horizontal Double Arm Kneaders, and in ⅓ the mixing time.



With no bearings or stuffing boxes in the product zone, stationary can, completely enclosed mix, and remotely controlled raising and lowering device, the Mixers are as safe in operation as they are efficient. Mixers have low original and maintenance cost, are easy to clean, and extremely versatile in operation.

Lower Illustration shows an 85 gallon #130-CDM Double Planetary Change Can Mixer furnished a leading concern for mixing plastisols of several types ranging up to 200,000 centipoises. Customer reports Mixer in operation 24 hours/day with mixing time per batch only 15-20 minutes; while the quality of mix and dispersion is so high that the final product is obtained in the Mixer alone – without further processing through a Three Roll Mill as was previously necessary with other Mixers.



Jacketed cans for heating or cooling material during mixing, dolly trucks, gates on cans for discharge, and vacuum tight covers can be provided.

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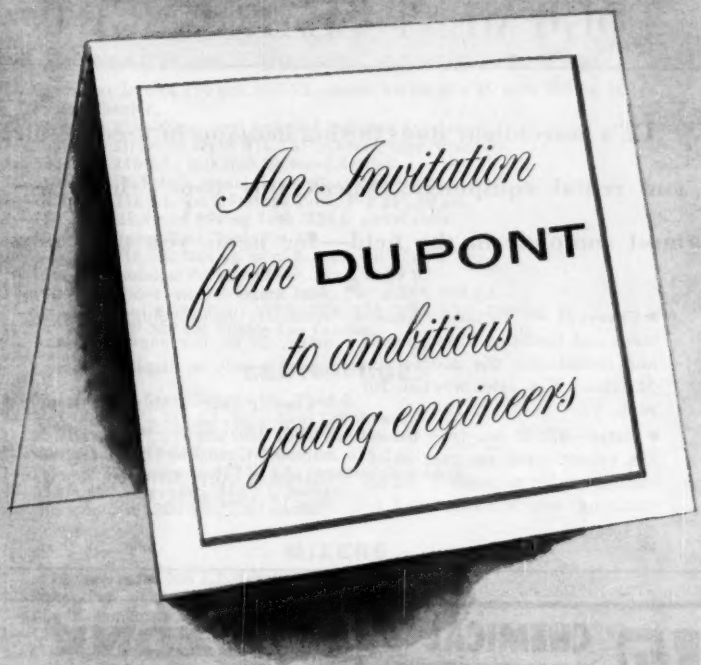

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3—Sturtevant Fans Design 4 Size 85.
1—25 H.P. Allis Chalmers Motor and 4" Centrifugal Pump.
1—Bowser Lubricating Oil Storage System (700 gal.)
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Attention Mr. R. Jochimsen,
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14—Storage Tanks: 3800; 6000; 9000; 10,000; 15,000; 47,000 gals.

MISCELLANEOUS

7—Dorr Thickeners: 16' dia. with Tanks.
1—Bemis 50# Bag Packer with Sewing Machine, Conveyor and Flattener.
50—LaBour, Durco, Worthite, Duriron and Stainless Steel Centrifugal Pumps 2" to 6" with motors.

Representatives on premises,
2701 Broening Highway, Baltimore, Md.
Telephone: Medford 3-2911

BRILL EQUIPMENT CO.
35-65 Jabez Street,
Newark 5, N. J.
Tel: Market 3-7420

CIRCLE L ON READER SERVICE CARD

OIL REFINERY

DESTREHAN, LA.

Partial List

5—B & W 70,000#/hr. Boilers, 450 psi. (1952)
3—Carrier Centrifugal Compressors; 38, 300, 9370 and 5535 cfm.
87—Heat Exchangers, 50 to 6000 sq. ft., steel and Adm.
15—Pressure Vessels, 3' to 23' dia.
125—Centrifugal Pumps, XP motor & turbine drives, up to 9000 gpm.
10—Steel Bubble Cap Towers, 2' to 12' dia., up to 109' high.
54—Storage Tanks, 1000 to 80,000 barrels.
6—Hortonspheres, 5000 to 10,000 barrels.

LIST AVAILABLE ON REQUEST
REPRESENTATIVE ON PREMISES

BRILL EQUIPMENT CO.
Site Office, Destrehan, La.
Phone NORCO 6571

CIRCLE M ON READER SERVICE CARD

BUY BRILL

REACTORS—EVAPS—CONDS—TANKS

1—Condenser Service 650 gal. 304 S.S. closed, kettle, 5' x 4', with 100 sq. ft. bayonet heater.
1—1400 gal. Blaw-Knox, steel jacketed, agitated Reactor.
1—2000 gal. Struthers Wells 316 S.S. jacketed, agtd. Reactors.
2—3200 gal. 316 S.S., jacketed, agitated Kettles.
1—550 sq. ft. Buflovak, monel single effect Evaporator.
1—7500 gal. 316 S.S. Vert. Storage Tank, 7' x 25', 50 psi.
1—750 gal, nickel clad Mixing Tank, 125# nickel coils.
1—4000 gal. Haveg Vert. Tank 8' x 12'.
1—4000 gal. 316 S.S. clad agitated Reactor with Coils.
1—1500 gal. Stainless Pressure Tank, 5' x 10', 90#.
1—12000 gal. horiz. steel Pressure Tank, 7'6" x 36", 200 psi.
6—Stainless Heat Exchanger; 1220, 786, 536, 396, 315, 250 sq. ft.
1—24" dia. x 25' 304 S.S. Bubble Cap Column.

CENTRIFUGES

1—Sharples C-27 Super-D-Hydrator, 316 S.S.
1—Bird 18" x 28", 316 S.S. Solid Bowl Continuous.
1—Bird 36" x 50", 347 S.S. Solid Bowl, Continuous.
2—Sharples PY14, PN14, Super-D-Canters, 316 S.S.
1—Tolhurst 32" Suspended, 316 S.S., imperforate basket.
2—AT&M 48" Suspended, 316 S.S. basket.
2—Sharples #16, 304 S.S., 3 HP motor.

MIXERS

1—#12 Sturtevant 304 S.S. Rotary Mixer, 450 cu. ft.
1—Baker, Perkins #16TRM, 150 gal. jktd., Vac. 60 HP.
5—Day "Cincinnatus" double arm, 250 and 100 gal.
1—1500# Powder Mixer, 7½ HP XP Motor.
2—Steel, jktd. Powder Mixers, 225 and 350 cu. ft.
1—36" dia. Simpson Intensive Mixer.

DRYERS

1—Buflovak Vacuum Shelf with 20—60" x 80" shelves.
1—Devine Vacuum Shelf with 19—59" x 78" shelves.
1—Devine Vacuum Shelf with 10—40" x 43" shelves.
2—Buflovak 42" x 120", atmospheric, double drum.
2—Devine, 4' x 9', single drum, atmospheric.
1—Baker Perkins 5'6 x 6' Rotary Vacuum Dryer.
1—Louisville 6' x 45' 316 S.S. Rotary Steam Tube Dryer.
2—Louisville Rotary Steam Tube 6' x 25', 6' x 50'.
9—Rotary Dryers, 34" x 30', 4' x 40', 6' x 50', 6' x 60', 7' x 80', 8' x 87'.
2—Louisville 8' x 50' Stainless Steel lined Rotary Dryers.
1—Traylor 30" x 18' Stainless Steel Rotary Dryer.
2—Link Belt, 7'5" x 25", 6'4" x 24', S.S. Louvre Dryers.

FILTERS

1—Oliver 6' dia. Horizontal Filter, 316 S.S.
1—Oliver 3' x 6' Steel Rotary Vac. Precoat Filter.
1—Niagara #370-38 Filter, 370 sq. ft., 304 S.S.
2—#49 Vallez Rotating Pressure Filters, 738 sq. ft.
1—Oliver 5'3" x 8' Steel Rotary Vacuum, vaporite housing.
1—Feinc 5' x 6' Stainless Steel Rotary Vacuum Filter.
2—#10 Sweetland Filters, 27 leaves, 4" centers, 250 sq. ft.

MISCELLANEOUS

1—Williams 5 Roll high side Mill, 100 HP.
1—Ross 6" x 14" Three Roll Mill.
3—Swenson Walker Continuous Crystallizers, 24" x 30' sections.
2—Robinson Sifters, 40" x 84", Stainless.
1—Robinson Gyratory Sifter, 30" x 104", Quadruple Deck.
8—Stokes; DD2, DDS-2, T, "R", and "F" Tablet Presses.
4—Nash Vacuum Pumps, H6, TS7, #2.
25—Chlorimet, Duriment and Duriron Centrifugal Pumps, 1½" to 6".
1—Raymond 10' dia. single Whizzer Separator.

PARTIAL LIST OF VALUES SEND FOR COMPLETE CIRCULAR

BRILL EQUIPMENT COMPANY
35-65 JABEZ STREET NEWARK 5, N. J.
Tel.: Market 3-7420 • Cable: Bristen
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CIRCLE N ON READER SERVICE CARD

FMC

IF YOU HAVE WORK TO DO WE HAVE THE MACHINE TO DO IT!

OUTSTANDING SELECTIONS

J. H. Day 40 Gal. Pony Mixers
J. H. Day Hi Speed 3 Roll Mills
J. H. Day 200 Gal. Paragon Mixers
Stainless Heat Exchangers to 1000 sq. ft.
S/S Patterson-Twin Shell Blender 150 cu. ft.
Pfaudler Glass Lined Jacketed Thimble Condenser; 26 sq. ft.

CENTRIFUGES and EXTRACTORS

Bird Continuous Conical Horizontal Centrifuges; 18"; 24"; S/S Monel
Sharples H2 Nozzlejector; 15 HP
Sharples Monel Model M4 P Centrifuge
DeLaval Type 316 S/S Hermetic Separator
Fletcher 12" and 30" S/S Centrifugals
Rubber Covered Centrifugals; all sizes

DRYERS and EVAPORATORS

Stokes Rotary Jktd. Dryer; 18' x 18'
Stainless Lined Rotary Dryer; 30" x 20'
B & S Dbl. Drum Dryer; 28" x 60"
Buflovak Dbl. Drum Dryer; 40" x 120"
Zaremba INCONEL Dbl. Effect Evaporator
Swenson Multi Effect Long Tube, Film Type Evaporators

FILTERS and FILTER PRESSES

Shriver and Sperry Filter Presses to 42" in Cast Iron, Stainless, Ni-Resist, Aluminum
Oliver Continuous Rotary Panel Type Vacuum Filters; 8' x 8' and 8' x 10'
Feine String Type Rotary Vacuum Filters 6' x 6' & 8' x 10'; Stainless contacts
Bird Young Rotary Vacuum Filter, 4' x 4'
Sweetland Pressure Filters No. 2 to 12
Enzinger Vertical Stainless Pressure Filter; 18" x 20"; ASME; 24 sq. ft.
Stainless Nutsche Type Filter 6' Dia. x 2'
Bowser Filter with Pump; 2000 GPH; 69 sq. ft.
Enzinger Leaf Type Filter, 48" x 57" Tank with 15 leaves; 360 sq. ft. surface.

REACTORS and PRESSURE VESSELS

Mojonnier S/S Vac. Pans; 3' x 10'; 6' x 12'
Nickel Clad Reactor; 7' x 11'6"; Jkt. Agt.
Struthers Wells Type 316 S/S; 1000-2000 Gal
Pfaudler Gl-Lnd; Jktd. Agtd. to 1000 Gals.
Lancaster S/S Lined Rotary Jacketed Reactor; 50" Dia. x 17'14" long
Three Stage Continuous Agitated Reactor, 3 Vessels 4'x20' in tandem
Dopp 650 Gal. C.I. Jktd. Agtd. Reactor
250 Gal. Hi-Pressure Forged Steel reactor, Jacketed and Agitated; 40" x 72"

PLASTIC and RUBBER EQUIPMENT

F-B Late Style 2 Roll Rubber Mills, 14" x 30"; 16" x 42"; 18" x 42"; 22" x 60"
Three Roll Calender: 22" x 58" complete
Baker Perkins Hv. Duty Mixers to 300 Gal.
Banbury Type "B" Laboratory Mixer
Two Adamson Vulcanizers; 16' long
Abbe Pebble Mills with Motors, Pebbles; 37" x 48"; 43" x 48"; 60" x 72"; 8' x 8'
Truck Dryers; 11' x 15' x 30'; 7' x 12' x 100'
Automatic Mechanical Dryer; 160' long
Automatic Washer for Late Pads
Southwark Hydraulic Presses; 30" x 36"
Dunning & Boschert Hydraulic Presses 36" x 36"
French Oil Mill Presses; 28" x 30"
Stokes Aut. Molding Press No. 252; 300 Ton
Extruders: Royle No. 1; Allen No. 2; NRM 1½"
Kux, Stokes & Colton Tablet Presses

MILLS — GRINDERS — PULVERIZERS

Abbe Jacketed Steel Ball Mills, 42" x 36" with charge of balls
International Porcelain Lined, Ball Mill 8' x 8'; 50 HP Motor
Patterson Jacketed Ball Mill, 54" x 42"; good for Vacuum
Mikro Pulverizers; up to No. 4's
Fitzpatrick Comminuting Mills, Stainless Steel; Models C, D, K
Mikro S/S Atomizers Model 5 & 6
Williams Hammer Mills to 16" x 48"
Williams Ring Roll Lab. Mills, 3 Roll, 10" x 3"; complete
Raymond Imp Mills; many models
American Ring Roll Crusher with 30" x 33" Throat; 50 HP Motor

Send for "FIRST FACTS" containing complete LISTINGS

FIRST MACHINERY CORP.
209-269 TENTH ST.
BROOKLYN 15, N. Y.
Sterling 8-4672

CIRCLE O ON READER SERVICE CARD

SAVE ON GOOD USED MACHINERY

Centrifugals: 12", 30", 40" & 48".
Centrifugals: Sharples #5 & #6 Stainless.
Dryers: Hersey 5'x26' Rotary, 316 Stainless Lined Buffalo Vac. Drum Dryer 24"x20". Lydon elec. heat Dryer 8 trays. Despatch Ovens Elec. Heated. Devine Vac. 8 shelf Dryer 38" x 42".
Filters: Vallez 49 S. S. covered leaves. #2 Sweetland 12 Stainless Leaves.
Filter Presses: 6" to 36" Iron & Wood.
Kettles: S.S. Jack. 20 to 500 gals. Dopp 350 gal. cast iron Jack. Vacuum. Devine Impreg. Units 30" & 36" dia. Steel Alum. & Copper 5 to 2,000 gal.
Mills: Raymond #00, 30 HP. & #0000. Mikro Pulverizers #4, 2, 1, & Bantam.
Hammer Mills & Pulverizers 3 to 50 HP. Rotary Cutters 1½ to 5 HP. & up. Spr. Waldron Stainless spike crusher. Pebble, Jar & Ball Mills, Lab. to 6' x 8'. 3 Roll, 9" x 32", 12" x 30", 16" x 40". Lehman 4 Roll W.C. 12' x 36" Steel. Colloid Mills 1½ H.P. & up.
Mixers: Baker Perkins jack, 100 gals. Day Imperial 75 & 150 gals. Change Can Mixers 8, 15, 40 gals. Day Jumbo 700 gal. horiz. mixer. Blystone 3000# horiz. spiral mixer. Day 1000# Ribbon Mixers, & up to 3000#. Lancaster 6' dia. 25 HP. & #1, HP.
Pumps: Stokes etc. Vac. 10 to 500 CFM. Gould 75 HP. Centrifugal 250 PSI.
Sifters: Day, Robinson, Rotex type.
Tablet Machines: Stokes Rotary BB2 & RD3. Single & Rotary ½" to 3".
New 14" x 30" Rubber & Plastic Mills.
Hydr. Presser, Plastic & Rubber Machy.

Partial Listings. Write for Bulletins

STEIN EQUIPT. CO.
107-8th St., Brooklyn 15, N. Y.
Sterling 8-1944

CIRCLE P ON READER SERVICE CARD

LOEB OFFERINGS

Autoclave: 50 gal. Struthers Wells, st. st.
Centrifugal: Tolhurst 20" st. steel (New).
Concentrating Table: Deister #14, 5' x 9'.
Dewaterers: Davenport 3A, bronze hd. 3 hp.
Disintegrator: Riets RD18P, 75 hp.
Dryers: Devine 2 x 4' vac. drum, st. steel.
Dryer: Bowen lab. spray st. steel.
Evaporator: Buflovak st. st. 94 sq. ft. Buflovak dbl. eff. model 850D.
Filter: Oliver precoat 12x2" st. steel.
Homogenizers-Disperser: Tri-Homo #10, #4
Kettles: st. steel, with and without ag. Dopp 150 gal. dbl. act. agitator.
Mills: Mikro, ISH, 5 hp. Day 3-roll high speed 14x30"
Mikro Atomizer type 5MA st. steel. Colloid, 3, 5, 20, 25 hp.
Mixers: Dbl. and sgl. arms sigma blade. Dry Powder, various sizes. W. & P. size 14, 50 gal. jktd.
Mix-Muller: Simpson Porto 39" st. steel.
Pumps: Rotary, gear, centrif. vacuum.
Screen: Rotex model 41 st. steel.
Still: Double effect st. st. 11.83 gal.
Tablet Press: Stokes DD2, 23 station.
Truck Tanks: Stain. steel 1200, 1600 gal.
Vacuum Pans: 42" and 72" stain. steel.

LOEB EQUIPMENT SUPPLY CO.
TELEPHONE Sterling 8-1431
320 WEST SUPERIOR ST. CHICAGO 10, ILLINOIS

CIRCLE Q ON READER SERVICE CARD

PIPE

2,000,000 ft. 2"	3.50# to the foot
1,000,000 ft. 3"	7.70#
1,000,000 ft. 4"	10.98#
500,000 ft. 6"	19.80#
200,000 ft. 8⅝"	28#
400,000 ft. 10¾"	35#
75,000 ft. 12¾"	40#
10,000 ft. 16"	42#

All No. 1 Grade Plain End and Cleaned
INDIANA-OHIO PIPE CO.
P.O. Box 5412 Shepard Sta. Phone CL 3-5527
COLUMBUS 19, OHIO

CIRCLE R ON READER SERVICE CARD

BUY ON TERMS!

ROTARY FLAME DRYERS
In Our Stock

23-Rotary Dryers immediately available from 2' dia up to 8'. Various lengths up to 80'. Both in Steel and Stainless Steel. Priced low for quick sale.

Send Us Your Inquiries

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FOR SALE NEW, PRICED RIGHT
CHAIN CONVEYORS—Stephens-Adamson
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MAGNETIC FLOW METERS
SYNTRON GRAVIMETRIC FEEDERS
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FORMER FELDSPAR MANUFACTURING FACILITIES

BON AMI, INC., MANCHESTER, CONN.

2—Hardinge 7' x 36" conical pebble mills, silex lined

19—Abbe Eng. 6' x 8' pebble mills, 30 HP drives

2—Buchanan 13" x 24" jaw crushers, 50 HP

1—Pangborn dust collector and 15 HP exhauster

2—Symons 3' shorthead cone crushers, fine bowl, 50 HP

1—Christie 4'-6" x 45' long rotary spar dryer, complete

1—Allis-Chalmers 6' x 18' pebble mill, buhrstone lined

5—Bucket elevators, up to 40' high, on rubber belts

SEND FOR CIRCULAR

STAINLESS STEEL TANKS

1—17,650 gal., horiz., T316 SS, 9' x 36', ¼" shell, ⅜" dished heads, 40# WP.
1—3700 gal., vert., T304 SS, 6' x 17', VACUUM, int coils.
1—3400 gal., horiz., T304 SS, 6'6" x 16', ¼" shell, 7/16" dished heads.
1—3300 gal., vert., T304 SS, 6' x 14'6", ⅜" shell, ⅜" heads, 70# WP.
1—2830 gal., horiz., T316 SS, 6' x 12', 5/16" shell & dished heads, VACUUM.
3—2750 gal., vert., T316 SS, 7' x 8', dished heads, 50# WP, 75 sq. ft. coil.
6—2600 gal., vert., T316 SS, 7' x 8', flat bottom, 19# WP, 5 HP agit.
1—2500 gal., vert., T316 SS, 7' x 7', ¼" shell, 5/16" dished heads, 70# WP.
6—2250 gal., vert., T316 SS, 7' x 6'3", dished heads, 70# WP, 5 HP agit.
1—1900 gal., vert., T316 SS, 6' x 8', ⅜" shell & dished heads, VAC. or 100#.
12—1750 gal., vert., hoppers, T304 SS, double cone bottom.
2—1200 gal., vert., T316 SS, 5' x 7', cone bottom, VACUUM.
1—575 gal., vert., T316 SS, 4' x 6', 3/16" shell, ¼" dished heads, 35 sq. ft. coil.
100—Tanks & vessels, 100 to 1000 gal., all types, etc.

BUBBLE-CAP COLUMNS T316 STAINLESS STEEL

1—110" dia. Vulcan—10 trays
2—96" dia. Vulcan—30 trays
1—96" dia. Vulcan—10 trays
1—60" dia. Vulcan—10 trays
1—48" dia. Vulcan—25 trays—T304 ELC
1—42" dia. Vulcan—Packed—32' high
1—36" dia. Vulcan—8 trays
1—24" dia.—Packed—28' high, T304

HEAT EXCHANGERS—CONDENSERS

1—2000 sq. ft., T316 SS condenser
1—1960 sq. ft., T316 SS exchanger, ASME
8—800 sq. ft., T316 SS condensers
60—T316 SS condensers & exchangers, 1450, 800, 735, 427, 400, 300, 264, 250, 235, 200, 165, 150, 125, 110, 47, 30
25—Copper & Cupro-nickel exchangers & condensers, up to 1070 sq. ft.

FILTERS—CENTRIFUGALS

1—Niagara #510-28, 510 sq. ft. vert. leaf, T316 SS.
1—Alco 110 sq. ft., T316 vert. filter.
1—Elmco 18" dia. x 24" face T304 SS rotary vacuum.
2—Oliver 5'3" dia. x 3' face rot. vac., pressure precoat, T316 SS, ASME 30# pressure housing.
1—Oliver 5'3" dia. x 8' face rot. vac., precoat, steel. UNUSED.
8—Sharples #AS-16V super cent. Inconel, Vapor-tite.
2—Sharples #16P, T304 SS pressure-tite centrifugals.
3—Sharples #C-20 Super-D-Hydrators, T316 SS.
2—Bird 18" x 28" horiz. cent., T304 SS.
1—Bird 32" x 50" horiz. cent., T316 SS.
2—Sperry 30" P. & F. filter presses, 18-9 st. st. (NI-RESIST).

BEST BUYS

3—10' dia. x 78' long rotary dryers, ¾" shell, 4' dia. center heat tube.
1—Kennedy Van Saun 7' x 9' contin. ball mill—150 HP.
12—4500 gal. nickel-clad tanks, 8' dia. x 11' high, cone bottom, 125# WP.
1—Struthers-Wells 630 sq. ft. T316 SS evaporator.
3—18,000 gal. Aluminum cone-bottom tanks, 12' dia. x 31' OAH.
1—Link-Belt #604-18 roto-louvre dryer, cyclone, fan, etc.
3—Worthington 160 ton steam-jet vacuum refrig. units.
2—Buffalo T316 SS Blowers, 2330 cfm, 60 HP TEFC. Motor.
2—1800 cu. ft. Read T304 SS weigh hoppers, with scales, T304 SS screw conveyor, bucket elevators, AJAX "Lo-veyor" shaker conveyors.
1—Vulcan 10' x 11' x 175' long rotary kiln, 13/16" shell, 2 tire.
1—Bartlett & Snow 3' x 15' everdur rotary dryer.

PERRY EQUIPMENT CORPORATION

1413-21 N. SIXTH ST. PHILADELPHIA 22, PA.

Phone POplar 3-3505

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FOR "IMPOSSIBLE" BUDGETS

3—6' x 50' Rotary Dryers, ½" shells. Completely equipped.

1—Allis Chalmers 6' x 50' Stainless Steel lined Dryers.

2—Bird 18" x 36" Horiz. Cont. Centrifuges. Steel. 15 HP Mtr.

1—St Regis Model 160 PB. 2 spout Bag Packer. W/Feeder & Controls

1—Pfaudler Model R 500 gallon glass Reactor. Turbine Agitator

1—Raymond #50 Imp Mill. Comp. w/new set of hammers

3—Eimco 8 x 12' Rot. Cont. Vac. Filters. Agit. Troughs

2—Harris 6' dia Stain. Evaporators. 345 sq ft area. Comp.

For immediate quote, wire or phone collect—GA 1-1380

ME MACHINERY AND EQUIPMENT COMPANY
123 Townsend St. · San Francisco 7, California

CIRCLE V ON READER SERVICE CARD

DIESEL LOCOMOTIVES & CRANES
3—New 25 Ton, 2 GE 1 Whitcomb.
3—23 Ton, 2-45 Ton Used Gen. Elec.
1—44 Ton, 1-80 Ton Used Gen. Elec.
3—100 Ton, Gen. Motors, Used
1—25 Ton, Industrial 60' Boom Loco. Crane.

PLANT EQUIPMENT
2—Wemco 2M-HMS-Plants.
36 x 42 Jeffrey Hammermill, Type B-2.
No. 5060 Dixie Mogul Hammermill 500 H.P.
2—6' x 36' Hardinge Ball Mills.
2—5' x 8' Kennedy Van-Saun air swept Ball Tube Mills with Motors & Elec. Eye.
7' x 24' Allis-Chalmers Tube Mill.
9' x 10' & 7' x 15' Rod Mills.
14 x 28 New England Jaw Crusher.
30" x 36" Traylor Type H Jaw Crusher.
48" x 72" Buchanan Type "C" Jaw Crusher.
36" x 72" Traylor Style G Jaw Crusher.
No. 1 Sturtevant Rotary Fine Reduction.
2' Symons Standard Cone Crusher.
36 x 20' Ruggles Coles Class XF-1 Rotary Dryer.
#207-10 & #705—24 Link Belt Roto Louver Dryers.
Link-Belt Mono-Tube 24-10 Dryers.
54" x 35' Louisville Monel Steam Tube Dryer.
72" x 28' Madison Rotary Dryer.
5' x 30' Ruggles Coles Class XA-8 Rotary Dryer.
8' x 60' Rotary Dryer, ½" Welded Shell in Calif.
9' x 160' Vulcan Rotary Kiln.
42" x 18" Traylor Type AA Crushing Rolls.
5'6 x 60' Rotary Dryer or Coler.
F55 Syntron Grizley Feeder.
24" x 95' NEW Hewitt Robins Truss Belt Conveyor.

R. C. STANHOPE, INC.
60 E. 42nd St. N. Y. 17, N. Y.
Tel. MU 2-3075

CIRCLE W ON READER SERVICE CARD

ROTARY DRYERS—24" x 22'—3' x 24'—4' x 40'—5' x 50' (w/25 HP drives) 6' x 32' (50 HP Gearmotor)—7' x 58' (50 HP gearmotor)

CRUSHERS—Jaw—2½ x 3, 2⅜ x 4 (new)—2 x 6 Sturtevant—9 x 16 Reliance—24 x 13 Reliance

MILLS—Ball—2' x 3' Patterson DJ—3' x 12' Abbe—5' x 6' KVS air swept—8' x 12' Hardinge w/200 HP drive

MILLS—Hammer—3 HP 00 Sturtevant—10 HP 2 DH Mikro—25 HP Raymond—50 HP 4TH Mikro w/collector (unused)—50 HP #2 Gruendler—125 HP Jeffrey 36 x 42—350 HP Penna. 26" x 76" opening

SCREENS—Tyler Hummer 3 x 5 (unused)—3 x 5 double—3 x 10 double—42" x 10" double Cedar Rapids—5' x 12' double Robbins—3 x 10 triple Diester

YOUR BEST REBUILT MACHINERY SOURCE

LAWLER COMPANY
Durham Ave. *Liberty 9-0245* Metuchen, N. J.

CIRCLE Z ONN READER SERVICE CARD

MOVING SALE
Ribbon Blenders, Steel & SS, all sizes, New & Used.
SS J'ktd. Ribbon Mixer, 24 cu. ft., 10 HP mtr.
Abbe 5'x8' J'ktd. Ball Mill, chrome mang. steel.
Oliver United Rotary Vac. Filter 3'x2'.
Rotex Sifter 20"x48", on high stand, w/½ HP mtr.
Gruendler "BB" Hammermill, Whirlbeater.
4 Mikro's-Bantam, #1S1, #2S1, #4, w/motors.
Gen. American 42"x120" Twin Drum Dryer.
Pfaudler 1500 gal. glass, closed top Tank.

WHAT HAVE YOU FOR SALE OR TRADE?
YOU CAN BANK ON

EQUIPMENT CLEARING HOUSE, Inc.
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SOuth 8-4451—4452—8782

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COMPRESSORS
World's Best Rebuilts
74 CFM 1500 PSI 6¼-3¾-1½x7 CP. TCB3
100 CFM 150 PSI 6x7 Ing. ES-1
104 CFM 2500 PSI 6¾-4¼-1 11/16x9 IR-ES3
110 CFM 3000 PSI Ing. GC 50BW
138 CFM 100 PSI 7x7, Ing., Ing. ES, CP. & Joy
151 CFM 3000 PSI 13¾x12 Norwalk TRS-4T
288 CFM 100 PSI 9x9 Ing. Worth. CP & Penn
311 CFM 1500 PSI 10½-7½-3½x13 IR-ES3
351 CFM 350 PSI 11-5x11 CP TCB-2
465 CFM 100 PSI 12x11-IR-ES-1-Chic. P.T.
502 CFM 125 PSI 12x13 Chic. T
686 CFM 100 PSI 14x13 Ing. ES-Chic. P.T.
778 CFM 125 PSI 14½-9x7 Ing. XLE
823 CFM Vac. 18x7 Ing. ES-1
877 CFM 125 PSI 17-10½ IR, XRB
1545 CFM 110 PSI 21-13x14 Ing. XRE
3/60/440 80% PF
3135 CFM Vac 31x13 Ing. ES Worth HB

AMERICAN AIR COMPRESSOR CORP.
Chem. Road, North Bergen, N. J. UNion 5-1397

CIRCLE AA ON READER SERVICE CARD

OVER 5,000 MACHINES IN STOCK
FOR EVERY INDUSTRY AND PURPOSE

- Wrappers
- Packaging machines
- Cartoning machines
- Fillers
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1—TRAYLOR 11'x155' ROTARY KILN, 2 tires, welded ⅞" shell, complete with drive and motor

1—LOUISVILLE ROTARY STEAM TUBE DRYER, 8'x45'

1—ROTARY DRYER 7'x60', 2 tires, ½" shell, complete with drive, motor, blowers and all auxiliary equipment

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1—ROTARY DRYER 6'x56', 2 tires, ½" shell, complete with drive, motor, blowers and all auxiliary equipment

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1—HARDINGE PILOT SIZE BALL MILL, 24" x 8", complete

1—PATTERSON ROD MILL, 4' x 11'6"

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THE GELB GIRL—APRIL 1960

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1—Type 316 SS 2000 gal. horizontal tank
2—Lee stainless steel 1000 gal. storage tanks
1—Pfaudler SS 5 gal. jacketed reactor, complete with impeller type agitator drive, 100 psi internal, 78 psi jacket
1—Van Alst 250 gal. SS jacketed kettle complete with SS column and condenser
2—300 gal. SS jacketed kettles, 100# W.P. jacket
3—Struthers Wells type 316 SS jacketed reactors, 2000 gal., complete with agitators and drives, 40# internal pressure
2—Pfaudler 200 gal. glass lined jacketed, reactors, complete with anchor type agitators and drives
1—Pfaudler 100 gal. glass lined jacketed reactor, complete with anchor type agitator and drive
1—Pfaudler 100 gal. glass lined vacuum receiver
2—Blaw Knox SS 600 gal. vacuum receivers, 29" Hg
1—Steel and Alloy Tank Co. 100 gal. type 347 SS pressure tank, 250 psi jacket
1—Struthers Wells type 347 SS pressure vessel 300 gal., complete with agitator and drive
1—Blaw Knox 400 gal. steel jacketed autoclave, 570# internal pressure, 85# jacket
1—18,000 gal. type 316 SS pressure tank, 11' x 24', 60 psi
1—Blaw Knox 45 gal. jacketed autoclave, 1500# pressure
1—Patterson Kelley 6000 gal. steel jacketed kettle
2—Steel jacketed reactors 2500 gal.
1—18,000 gal. aluminum storage tank
5—Aluminum storage tanks, 1300 gal. each

DRYERS

3—Link Belt steel roto louvre dryers, Model 207-10, 310-16, 604-20
1—Stokes Model 59DS steel rotary vacuum dryer, 5' x 30'
2—Louisville rotary dryer, 8' x 50', SS
1—Buflovak SS jacketed rotary vacuum dryer, 3' x 15'
1—Stokes SS jacketed rotary vacuum dryer, 2' x 6'
3—Buflovak steel jacketed rotary dryers, 3' x 15', 5' x 20' and 5' x 35'
1—Traylor 4' x 40' rotary dryer
1—Rotary dryer 6' x 36'

Button up your equipment cares—

Call on **GELB** for

CHEMICAL PROCESS EQUIPMENT

2—Stokes Model 138J-20 single door vacuum shelf dryers, 20 shelves, complete
1—Western Precipitation Corp. SS pilot spray dryer, Type N-2

FILTERS

3—Dorrco rubber covered filters, 6' x 2'
12—Sweetland #12 Filters with 72 SS leaves
1—Niagara SS filter, Model 510-28
1—Oliver SS rotary pressure precoat filter, 5'3" x 8'
1—Oliver horizontal filter, 3'
10—Shriver plate and frame filter presses, 12" x 42"
1—Shriver aluminum 30" x 30" P&F filter press, 30 chambers
1—Sperry aluminum filter press, 18" x 18" P&F 16 chambers

CENTRIFUGES

1—AT&M 48" SS suspended type centrifuge, complete with plow, motor and imperforated basket
1—Fletcher 48" center slung SS centrifuge complete with perforated basket and motor
4—Tolhurst 40" center slung rubber covered centrifuges with perforated baskets and motors
2—Fletcher 40" center slung rubber covered centrifuges with perforated baskets and motors
1—AT&M 40" SS suspended type centrifuge, complete with motor and plow with perforated baskets and motors
1—Western States vaportite type 316 SS under driven centrifuge with 36" perforate basket, with unloader and motor, bottom discharge

MIXERS

15—Robinson type 304 SS horizontal blenders, 255 cu. ft.
1—Howes horizontal rubber covered ribbon blender, 40 cu. ft.
2—Sturtevant #7 dustite rotary batch blenders, (NEW)
1—Baker Perkins Size 16 Type TRM, 150 gal. jacketed double arm sigma blade mixer with vacuum cover
1—Baker Perkins Size 20, 2000 gal. double arm jacketed vacuum mixers with double naben blades
1—Entoleter impact mill type PPM-27
1—Stokes SS granulating mixer, Model 211
3—Banbury #1 mixers, chrome plated rotors, with 50 HP motors
1—Baker Perkins Size 16, Type UUEM, 150 gal. jacketed double arm dispersion type mixer, complete with compression cover and 100 HP motor

MISCELLANEOUS

1—York Shipley 175 HP package steam generator, 135# psi
1—Vulcan SS bubble cap column, 4' x 28 plates
1—Badger type 316 SS bubble cap column, 42" dia. with 11 trays
1—Badger type 316 SS bubble cap column, 36" dia. with 8 trays
1—Struthers Wells type 316 SS heat exchanger, 330 sq. ft.
1—Condenser Service type 316 SS heat exchanger, 350 sq. ft.
3—Badger type 316 SS heat exchangers, 500 sq. ft. and 600 sq. ft.
10—Davis Engineering SS heat exchangers, 145 sq. ft. (NEW)
4—Davis Engineering Corp. 20 heat exchangers, 120 sq. ft. each (NEW)
1—Downington type 316 SS heat exchanger, 750 sq. ft.
2—Swenson type 316 SS vacuum crystallizers, 3'6" x 12', 2' x 12'
3—Williams type 316 SS hammermills, Model AK
1—Sprout Waldron Model 501-D pelleter
1—Ross 6" x 14", 3 roll paint mill, complete
1—Sweco 48" SS separators, Model D-2D-8
1—Stokes stainless steel coating pan, 3' dia.
50—Steel heat exchangers, 15 sq. ft. to 100 sq. ft.

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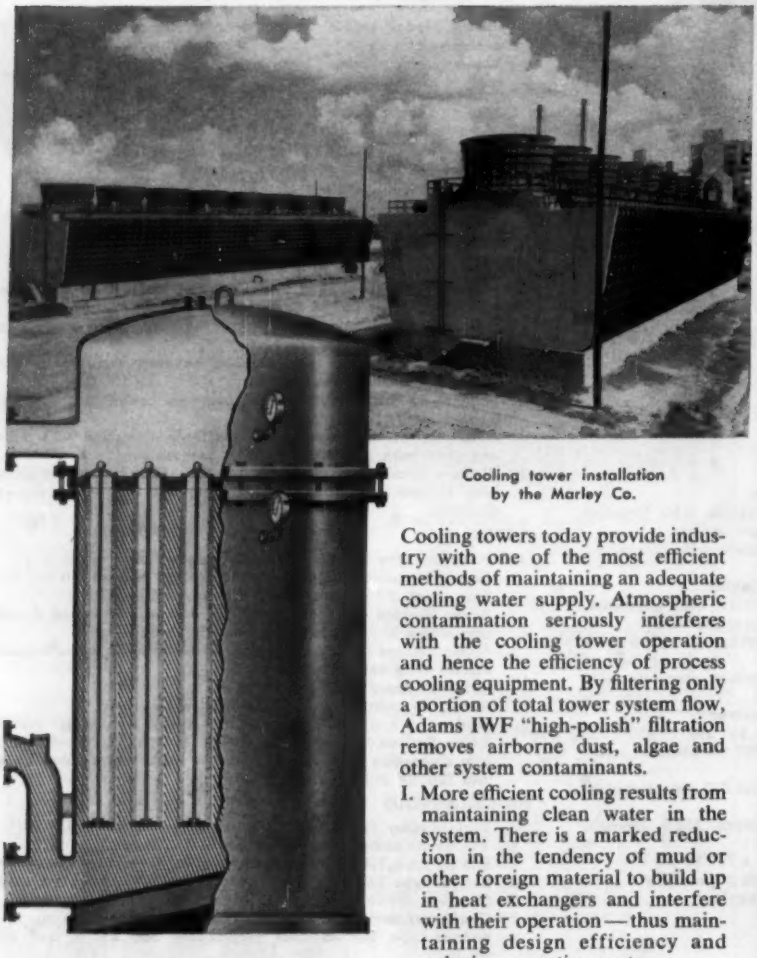
HOW ADAMS IWF FILTERS CUT COOLING TOWER COSTS



Cooling tower installation by the Marley Co.

Cooling towers today provide industry with one of the most efficient methods of maintaining an adequate cooling water supply. Atmospheric contamination seriously interferes with the cooling tower operation and hence the efficiency of process cooling equipment. By filtering only a portion of total tower system flow, Adams IWF "high-polish" filtration removes airborne dust, algae and other system contaminants.

I. More efficient cooling results from maintaining clean water in the system. There is a marked reduction in the tendency of mud or other foreign material to build up in heat exchangers and interfere with their operation — thus maintaining design efficiency and reducing operating costs.

II. Adams IWF Filters save water, particularly important where water is scarce or costly since there is a marked reduction in the necessity to drain and refill the system for cleaning.

III. The amount of chlorine, rust inhibitors and other chemicals normally added for water control are minimized — another cost-saving feature.

IV. By reducing the frequency of manual tower cleaning, production labor and down-time are greatly reduced.

Isn't it worth investigating? Write today for Bulletin 651, or contact your nearby Adams engineer. See how economical IWF Filters are to buy, install and operate — due to their compact design, simplicity of piping, longer filtration cycles and the higher efficiency of Adams "pressure-dome" backwashing — the easiest and fastest available in any filter package.

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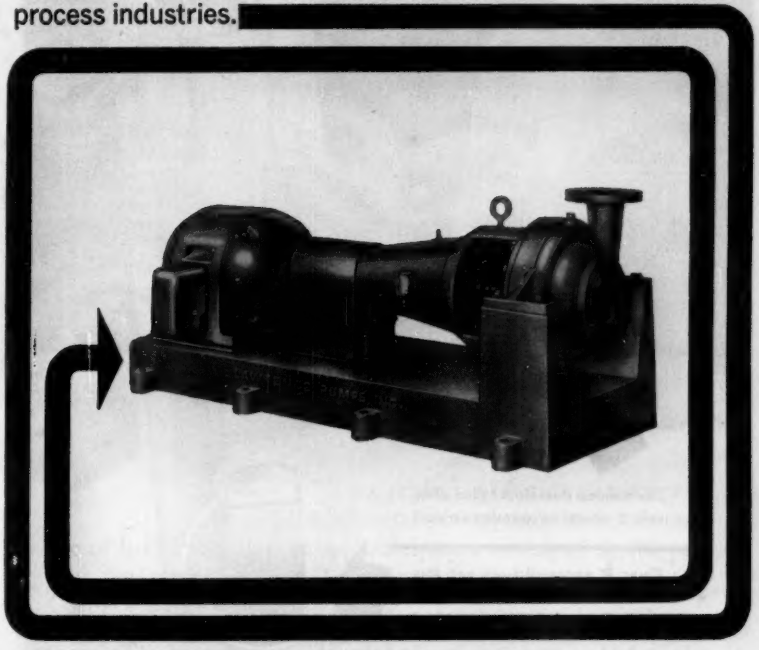

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Centerline support — to prevent misalignment in handling high temperature liquids.

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Extra deep packing box, renewable sleeve — usable either with packing or mechanical seals.

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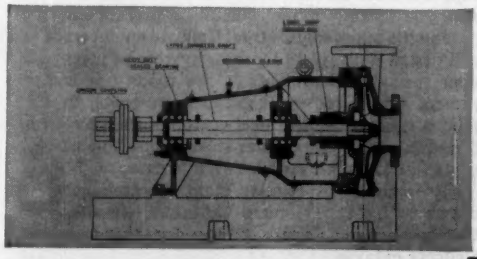

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This stainless steel stack failed after only 6 months in corrosion service!
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"Since replacing filter cloth with perforated metal plates, and the continued use of E-D Filter Papers, we anticipate a saving of $1,000 per year per press," reports A. C. Jocelyn, President, Royal Oil Corp. of Baltimore.

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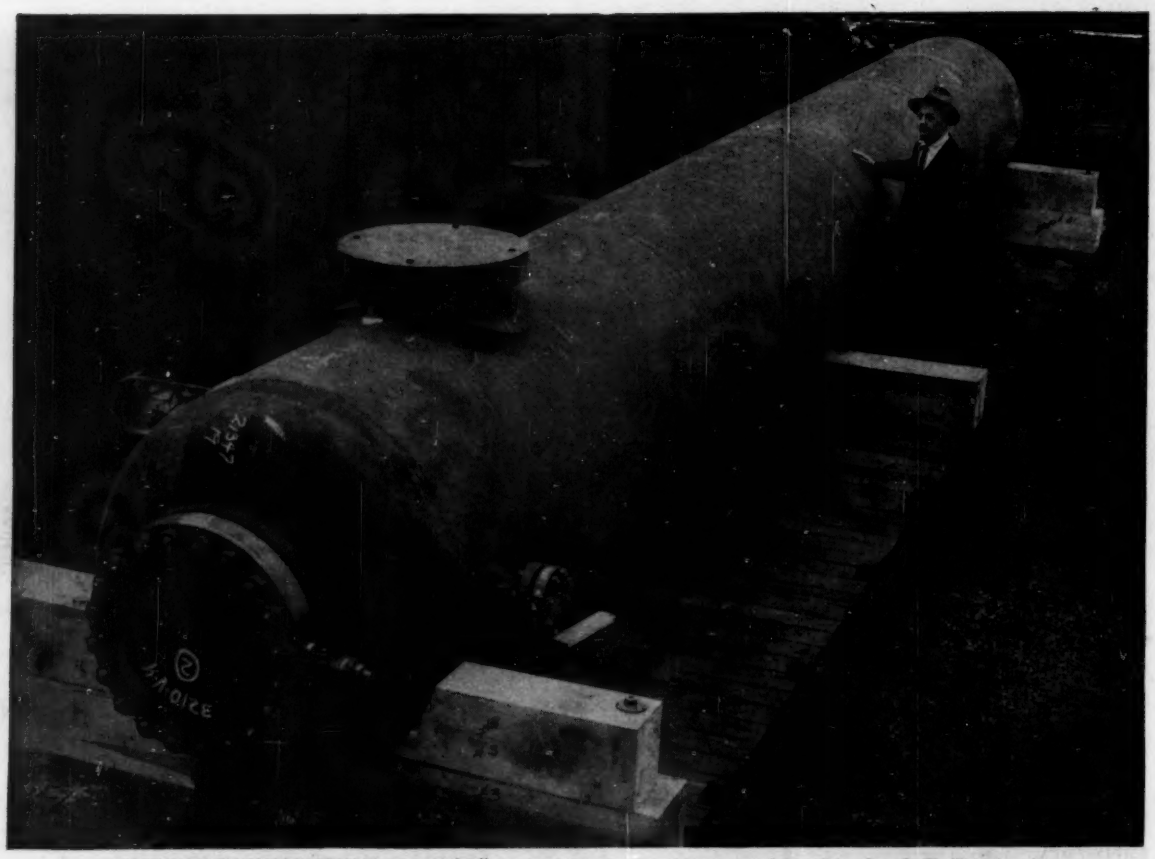

NEWPORT NEWS BUILT two 39'-7" horizontal gas scrubbers, such as this, for J. F. Pritchard & Co. They were made of ASTM-A212 Grade B fire box steel, with structural mesh steel interiors.

Gas scrubber made of 2⅞" steel

Newport News builds almost any type of pressure vessel and other heavy process equipment

Here is one of two horizontal gas scrubbers recently built for an operating pressure of 1800 psi at 300°F.

Newport News made both vessels from fire box steel, 2⅞ inches in thickness. We formed and automatically welded this steel into sections having a diameter of only 4 feet.

Rolling thick steel to this small diameter...no easy accomplishment, as you probably know . . . demonstrates the sort of jobs Newport News takes in stride.

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Newport News shop erection of fabricated units helps to speed assembly at your plant site.

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ROLLING 2⅞" STEEL for gas scrubbers. The steel, in a hot condition, was formed on the heavy bending equipment shown here. It will cold roll mild steel up to 3 inches thick, and will hot roll any grade of steel up to a thickness of 5 inches.

Newport News Shipbuilding and Dry Dock Company
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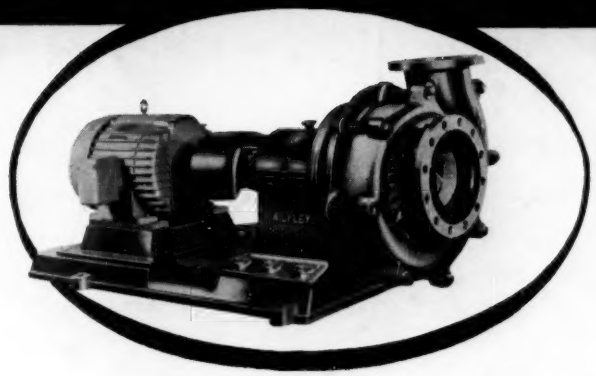

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Pumping parts are available in a variety of metal alloys, as well as plastic, to cover a wide range of corrosive applications. 1″ to 8″ discharge sizes with 10 to 3000 GPM capacities and heads up to 200′ and higher. Write, wire or phone for complete details.

A. R. Wilfley and Sons, Inc.

Denver, Colorado, U.S.A., P.O. Box 2330

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WILFLEY ACID PUMPS
"COMPANIONS IN ECONOMICAL OPERATION"
WILFLEY SAND PUMPS

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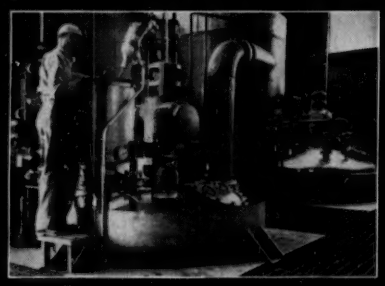

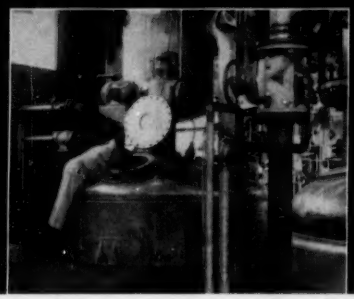

GOOD MIXING is key to process control in butadiene-styrene reactors at new Dewey and Almy plant.

How they keep molecules from running amok in push-button latex plant

Look at the heart of this process, and you'll see LIGHTNIN Mixers working.

They're helping to make little molecules into big ones—20 million pounds of them a year—at the new Owensboro, Ky., plant of Dewey and Almy Chemical Division, W. R. Grace & Co.

Process control is exceptionally tight on the new plant's two parallel lines producing butadiene-styrene latices and PVAc emulsions for a host of uses. Either line can produce many types of emulsions to meet customers' special needs.

What mixers do

In each polymerization reactor, a turbine-type LIGHTNIN Mixer whips incoming monomers into an emulsion. Then, as the batch heats up to its catch point, the mixer keeps it turning over rapidly at uniform temperature throughout.

Once polymerization begins, heat control is critical; a rise of 10° F will double the reaction rate. Turbulence and flow from the big flat-blade turbines provide a high rate of heat transfer that helps to get excess heat out of the batch as rapidly as possible. As a result, heat-sensing devices in the reactor can feed accurate data back to the plant's automatic control center.

Ahead of the reactors, other LIGHTNIN Mixers swiftly combine monomers, emulsifiers, and catalysts to make up the reactor charge. At the far end of the line, LIGHTNIN Mixers also blend finished products, prior to shipment.

What's your mixing problem?

For your fluid-mixing operations, you can get LIGHTNIN Mixers as advanced as your own thinking. On complex mixing jobs, you can save precious hours of engineering by coming to MIXCO—and get the right answer, with mixing results unconditionally guaranteed.

On *any* fluid-mixing job, LIGHTNIN Mixers give you the widest possible choice of standard mixer designs, in sizes up to 500 hp, with maintenance features that keep your mixing costs low for years to come. Your LIGHTNIN Mixer representative can tell you more. Look him up in *Chemical Engineering Catalog* or the yellow pages of your phone book, or write to us.

"Lightnin Mixers"

MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 128-d Mt. Read Blvd., Roches[illegible] 3, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toro[illegible] 19, Ont.